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THE SCIENTIFIC INTERESTS OF SENIOR
SCHOOL CHILDREN.

By R. RALLISON.

- I.—*Introduction.*
- II.—*Method of investigation.*
- III.—*Are children interested in science?*
- IV.—*In which sciences are children interested?*
- V.—*Science topics most interesting to seniors.*
- VI.—*Influences on the scientific interests of seniors.*
- VII.—*Summary of conclusions.*
- VIII.—*References.*

I.—INTRODUCTION.

RECORDS of the investigation of the interests in science of children at the infant and junior stages already exist. Two parents¹, in the *Scientific Interests of a Boy in Pre-school Years*, show that genuine scientific interest first manifests itself at about four years of age². H. R. V. Ball³ has supplied results from junior children. C. Washburne, the American psychologist, has worked out the scientific interests of American children and based on his research a textbook⁴ for science teaching in secondary schools. This investigation concerns English senior school children between the ages of eleven and fourteen; it is an attempt to reveal the nature of their scientific interests.

Evidence has been collected and summarised to illuminate six aspects of the problem of scientific interest, viz.:

- (1) What is the relative distribution of interests between the scientific and non-scientific fields?
- (2) What is the "pattern" of the interests shown by children in the various science branches?
- (3) Which topics seem most interesting to children?
- (4) What are the typical questions that characterise the ages?
- (5) What is the influence of age on scientific interests?
- (6) What is the influence of environment on scientific interests?

II.—METHOD OF INVESTIGATION.

The following instructions were cyclostyled and, with a covering note, sent by post to forty school departments in the City of Newcastle-upon-Tyne and to ninety-seven schools in the remote rural areas of the County of Northumberland; between Newcastle and the rural parts of

The questions on non-scientific topics were simply counted; a supplementary investigation is to analyse fully their content and indicate their nature. On the numbers of boys and girls mentioned above, it was found that 4,931 questions from boys and 12,333 questions from girls came in this category.

III.—ARE CHILDREN INTERESTED IN SCIENCE?

After investigations had proceeded for some time with city children, it was realised that by counting the questions and references to non-scientific topics, instead of merely rejecting them, some information as to the extent of the interest of children in the science field, compared with their interest in other directions, might be obtained. All the interest sheets for township and rural children were counted in this dual way for scientific versus non-scientific influences. Table II summarises the results obtained; it gives the relative numbers of questions collected in the non-scientific and scientific fields; from these figures were calculated ratios "non-scientific/scientific" to indicate the distribution of the interest-field for each type of children.

TABLE II.—"NON-SCIENTIFIC/SCIENTIFIC" DISTRIBUTION OF INTEREST.

Age.	CITY.					
	Boys.			Girls.		
	N.Sc.	Sc.	Ratio N.Sc./Sc.	N.Sc.	Sc.	Ratio N.Sc./Sc.
11+	203	1824	0.11	1698	1095	1.6
12+	122	1248	0.10	959	696	1.4
13+	107	980	0.11	1285	924	1.4
TOWNSHIP.						
11+	350	670	0.52	1116	641	1.7
12+	1078	1749	0.61	1890	1322	1.4
13+	636	1511	0.42	1671	1486	1.1
RURAL.						
11+	666	1060	0.63	957	537	1.8
12+	1101	1332	0.73	1347	546	2.4
13+	666	1239	0.54	1410	846	1.6

Note : N.Sc., Non-scientific ; Sc., Scientific.

Inferences made from the study of these figures are :

- (1) A great difference exists between the sexes with regard to the distribution of interests ; boys seem to concentrate their interests in the scientific field ; girls are much less interested in scientific topics—their interests are much more widespread around a definite, small core of scientific interests.
- (2) Environment seems to have a much greater influence on the distribution of boys' interests between the non-scientific and scientific fields than is evident with girls ; city boys have the greatest proportion of interests in science ; township boys come second to them in this respect ; rural boys have, for boys, the least proportion of interests lying in the field of science, although their interests are nothing like as widespread as was found for girls. Girls from all types of environment are remarkably similar in the constancy of their interests, tending mainly towards the non-scientific. Evidently, environment has a much more potent effect on boys' interests than girls'.

The first inference is supported by Shakespeare's results in *An Enquiry into the Relative Popularity of School Subjects in Elementary Schools*⁵, where is pointed out, ". . . a scientific outlook seems evident in the boys' lists . . . girls seem to maintain or develop an interest in reading, composition and literature . . ."

Similar confirmation is obtained from Hoy's "*An Enquiry as to the Interests and Motives for Study among Adult Evening Students*."⁶ The question ". . . would you like to attend a class in science treated in a popular way as if affects your everyday life ?" was put to find out the opinion in regard to this "rather undeveloped branch of adult education." "Seventy-eight per cent of the replies were in the affirmative . . . the demand for science among women was very pronounced."

The ratios, "non-scientific/scientific," proved of value as they afforded a bridge over which comparison became possible with Ball's⁷ results for juniors. From his data⁷, it was possible to calculate a value for the ratio, "non-scientific/scientific." A value of 0.5 resulted. As this value is of the same order (in the mathematical sense) as the values given in Table II, it seems that the interests at the senior and junior stages are similar as regards their distribution into non-science and science.

IV.—IN WHICH SCIENCES ARE CHILDREN INTERESTED ?

The number of times children in an age-group asked questions which on analysis could be included in a science-branch was taken as an index of the total interest of the age-group in that science-branch.

Thus, the 11+ group of city boys asked 859 questions with a biological significance out of a total of 4,121 questions. From similar sets of raw scores for questions from each type of environment dealing with electricity, chemistry, light and the other science-branches, it was possible to calculate the percentage distribution of scientific interests with reference to the different science-branches. Table III summarises the results obtained.

TABLE III.—PERCENTAGE DISTRIBUTION OF SCIENTIFIC INTERESTS.

<i>Science Branch.</i>	<i>City.</i>			<i>Township.</i>			<i>Rural.</i>		
Boys :	11+	12+	13+	11+	12+	13+	11+	12+	13+
Biology	21	23	18	31	29	28	38	36	38
Electricity.....	17	14	18	15	8	20	5	7	11
Chemistry ...	17	21	18	12	13	16	11	12	14
Mechanics.....	13	12	15	10	14	19	16	15	14
Light	6	6	8	3	2	1	2	4	3
Astronomy ...	6	6	6	6	6	3	6	4	4
Heat	5	5	5	4	8	1	5	8	3
General (Topics difficult to classify)	5	5		14	17	7	13	11	
Geology.....	4	2		3	3	5	2	2	
Sound	4	3		2	2	1	3	2	
Magnetism ...	1	1		0	0	0	1	0	
GIRLS :									
Biology ...	31	24	35	24	32	37	39	41	44
Electricity...	10	14	15	11	8	10	5	5	6
Chemistry .	26	25	18	14	15	21	23	19	19
Mechanics .	9	8	5	19	13	7	7	9	6
Light	5	6	5	5	3	4	2	3	3
Astronomy	4	6	8	7	5	7	2	3	6
Heat	4	5	3	6	3	7	3.5	1	5
General ...	3	6	5	2	7	3	6	13	3
Geology...	4	1.5	4	9	11	4	0.6	0.5	2
Sound ...	4	5	2	3	3	1	13	5	5
Magnetism	1	0.9	0.6	0.6	0.3	0.1	0	0	0

It is possible to make some comparison between these results and results from other relevant investigations. From Table III, *Scientific Interests of a Boy in Pre-school Years*⁸, have been calculated the following percentage distributions for spontaneous scientific interests over the age-range, two to five years :

Biology (sum the given data for animal life, self, babies, physiology, and plant life)	33%
Chemistry	10%
Mechanics	7%
Astronomy	15%
Physics (compare with the aggregate of results for electricity, light, heat, sound, and magnetism in Table III above) ..	27%

The general spread of the "pre-school" results is quite similar to that obtained for senior children in all districts. Recalculations were also made from Ball's data⁹ for the junior stage. This source gives about 32 per cent of junior interests in the biological field, which is quite comparable with the biological results contained above in Table III.

A suggestion that seems to arise from these comparisons of the distribution of interests in sciences at the pre-school, junior, and senior stages, is the predominance throughout of an interest in biology. For American children, however, Washburne¹⁰ found that biology came fourth in order of "interest"; physics came first, astronomy second, and physical geography third.

Study of Table III itself reveals certain tendencies; these are:

- (1) Four science-branches dominate the interests of both sexes, viz.: biology, chemistry, mechanics, and electricity.
- (2) Boys and girls are interested in the same sciences.
- (3) The character of the kind of science they are interested in seems to depend to some extent on the environment, particularly with rural children.
- (4) City and township children seem to possess a rather more widespread interest in a larger number of sciences than rural children, but the rural children seem to compensate for this by a more concentrated interest in a fewer science-branches.

V.—SCIENCE TOPICS MOST INTERESTING TO SENIOR CHILDREN.

It has been proved that "Learning is much more effective if preceded by questions which let the child's mind forecast what he is going to learn."¹¹ To enable the science teacher to apply this by using the questions about scientific topics that naturally occur to children, a selection is now to be given of the more typical questions. The soundness of starting from the child's own questions is pointed out by three recent influential sources, viz.: Board of Education *Handbook of Suggestion* says, "... the questions that arise spontaneously in their minds . . . should be the starting point for the teaching"¹²; again the same phrase, this time applied to the middle forms of secondary schools, appears in the Board of Education Pamphlet 114¹³; finally, the Science Masters' Association advocates in *General Science* an attempt being made to "try to teach a child the things he wants to know."¹⁴ As a preliminary to being able to do this, they recommend finding the questions a boy wants answering.

CLASS I.—UNIVERSAL INTERESTS.

The following questions were found to be outstanding in arousing the curiosity of children of all ages (boys and girls) in the three kinds of environment used :

BIOLOGY INTERESTS.—*Human body*. How hair grows? ; how we breathe? ; how eyes work?

Animals. How do fish breathe? ; how do fish swim? ; about worms ; how hen makes eggs? ; about insects ; how do birds fly? ; about birds' habits ; how is chalk made? about wild animals.

Plants. Why are flowers scented? ; why are flowers coloured? ; how do trees grow? ; how do plants grow?

ELECTRICITY INTERESTS.—How does wireless work? ; how does telephone work? ; cause of thunder and lightning ; about electricity.

CHEMISTRY INTERESTS.—How is paper made? ; why is the sea salty? ; how does a fire burn? ; how is ink made? ; how is glass made? ; how is coal gas made?

MECHANICS INTERESTS.—How does an airplane fly? ; how do clocks work? ; how does a bicycle work? ; how does a steel ship float?

LIGHT INTERESTS.—Why do glasses magnify? ; how does a camera work? ; how does a cinematograph work? ; why is the sky blue? ; how does television work?

ASTRONOMY INTERESTS.—What are stars? ; about the sun.

HEAT INTERESTS.—How is rain caused? ; how does water freeze? ; how does steam work an engine?

GENERAL SCIENCE INTERESTS.—How does a motor car work? ; about science and scientists.

GEOLOGY INTERESTS.—Cause of earthquakes? ; how was the earth made?

SOUND INTERESTS.—How does the gramophone work? ; how does the piano work?

MAGNETISM INTERESTS.—Why does a compass point north?

CLASS 2.—INTERESTS CONFINED TO A PARTICULAR ENVIRONMENT.

C.=City ; T.=Township ; R.=Rural.

BIOLOGY INTERESTS.—*Human body*. How grows (C.).

Animals. How milk gets inside a cow (R. and C.) ; about horses (R. and T.).

ELECTRICITY INTERESTS.—How tramcar works (C.) ; how does a dynamo work? (C. and T.) ; how is electricity made (C. and T.) ; how does an electric bell work? (C.).

CHEMISTRY INTERESTS.—How do matches work? (C. and T.); how is coal made? (C.); how do fire extinguishers work? (C.).

MECHANICS INTERESTS.—About pneumatic drills (C.); how does a vacuum cleaner work? (C.).

LIGHT INTERESTS.—How do you see in a mirror? (C.); how does a periscope work? (C.).

ASTRONOMY INTERESTS.—What are comets? (C.).

HEAT INTERESTS.—How does a thermometer work? (C.).

GEOLOGY INTERESTS.—How is sand made? (T.); how do we know where coal is? (T.).

SOUND INTERESTS.—How do talkies work? (C.).

CLASS 3.—INTERESTS CONFINED TO A PARTICULAR SEX.

B=Boy; G.=Girl.

BIOLOGY INTERESTS.—*Human body*. How do teeth grow? (G.); how born? (G.); where has man come from? (B.); what is the difference between a boy and a girl? (G.).

ELECTRICITY INTERESTS.—About Morse code (B.); how an electric train works? (B.); how does an electric light work? (B.).

CHEMISTRY INTERESTS.—How is dynamite made? (B.); how is gunpowder made? (B.); what is petrol? (B.); how is tar made? (G.); about gases (B.); about acids (B.); how are diamonds made? (G.).

MECHANICS.—How do the sun and moon keep up? (B.); how does a submarine work? (B.); what keeps an airship up? (B.).

ASTRONOMY INTERESTS.—Any people on Mars? (B.).

HEAT INTERESTS.—How does a turbine work? (B.).

CLASS 4.—INTERESTS CHARACTERISTIC OF AN AGE.

(NOTE : These questions occurred in only the single age-group indicated by the figures.)

SECTION A.—BOYS.

BIOLOGY INTERESTS (11+).—How does a cat meow?; why has a horse four legs?; why has a camel a hump?; why do leaves fall in winter?; how do plants live in the desert?; how does the oil get in orange skin?; how does the milk get in cocoanuts?

(12+).—How does the head ache?; why has a caterpillar so many legs?

(13+).—How do we taste?; why do we yawn?; how does the kangaroo jump?; how do flowers grow?; why are grass and leaves green?; how does the mould get on cheese?

ELECTRICITY INTERESTS (13+).—About accumulators; how do wires fuse?; how does electricity work?; how does a motor horn work?; how does an electric fan work?; how does a transformer work?

CHEMISTRY INTERESTS (11+).—Who invented chemicals?; how does coal gas burn?

(12+).—What is steel?; how does a film work?

(13+).—Who invented ink?; how is glass coloured?; about Neon; how is the atom split?

MECHANICS INTERESTS (12+).—Why does blotter suck in ink?; how does a fountain pen work?

(13+).—How has the earth been weighed?; how does a buoy float?; why are we thrown forward when a train stops?; why does a bus not overturn when cornering?

LIGHT INTERESTS (11+).—How are colours formed?; how is light made?

(12+).—How are mirrors made?

(13+).—How does the sextant work?; how are there such colours in a diamond?; what is light?

ASTRONOMY INTERESTS (13+).—What happens when a comet falls?; how high is the sky?

HEAT INTERESTS (11+).—How radiators work?; how is asbestos fireproof?

(13+).—How is fog caused?; how does a thermos flask work?

GEOLOGY INTERESTS (11+).—How are ores formed?; how is gold obtained?

(13+).—What is a geyser?

SOUND INTERESTS (11+).—How does the concertina work?

(12+).—How does a bell work?

(13+).—How does a dictaphone work?

MAGNETISM (13+).—How does an electromagnet work?; how do we know the world is a magnet?

SECTION B.—GIRLS.

BIOLOGY INTERESTS (11+).—How the head aches?; why has a horse four legs?

(13+).—How the body works?; how is the butterfly formed?; how does a glow-worm glow?; why cannot amoeba be killed?; why are leaves, etc. green?

ELECTRICITY INTERESTS (11+).—How does electricity not pass rubber?; how does the switch put on electricity?

(12+).—How do X-rays work?; how do lightning conductors work?

(13+).—How many volts of electricity kill?

CHEMISTRY INTERESTS (11+).—Why is some water hard? ; how does coal gas burn? ; how do gas masks work? ; how does salt form colours in the fire? ; how does sugar make the fire flare up?

(12+).—How is iron made?

(13+).—How is poison gas made?

MECHANICS INTERESTS (11+).—How do wheels work?

(12+).—What is gravity?

LIGHT INTERESTS (12+).—How is light made?

(13+).—How are colours formed? ; how are there such colours in diamonds?

ASTRONOMY INTERESTS (11+).—What is our distance from the sun?

(13+).—About the planets.

HEAT INTERESTS (11+).—How does salt thaw ice? ; how does hot water crack thick glass? ; why are the tops of mountains cold when they are nearer the sun?

(12+).—How are ocean currents formed?

GEOLOGY INTERESTS (11+).—What is lava? ; why is the earth round? ; how is china made?

(13+).—How is tin got from the ground? ; what is the inside of the earth like?

SOUND INTERESTS (12+).—How does the violin work?

TOTAL NUMBER OF MAIN TOPICS—170.

The scientific interests indicated by the records of questions children want answering were found to represent the major part of their interest in science. The total number of questions asked on the MAIN topics indicated in Classes 1-4 were counted, as was the total number of questions asked on all science topics. Forty-eight per cent of the total questions were confined to the MAIN topics indicated ; the remaining 52 per cent of the questions were scattered over 412 other miscellaneous scientific topics.

VI.—INFLUENCES ON THE SCIENTIFIC INTERESTS OF SENIORS.

Table IV shows the results of an analysis of the data obtained to find the influence of age on the main scientific interests of seniors ; as far as possible the aim was to decide at what age a particular interest originated. The table was obtained by counting the number of topics in each of the three environments that persist through the age-range 11-13+, i.e., such topics were acquired before the beginning of the senior stage ; in addition, were counted in each environment the topics acquired in ages 12+, persisting to 13+ ; finally were included the topics for each environment acquired in the ages 13+.

TABLE IV.—ORIGINATING AGES FOR MAIN INTERESTS IN SCIENCE AT 13+.

Source.	Total Number of Topics relating to Specified Source.						Per cent Main Interest Field relating to Specified Source.					
	City.		Township.		Rural.		City.		Township.		Rural.	
	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.
Acquired before 11+, persisting to 13+	104	87	35	21	53	38	90	90	34	30	56	46
Acquired in 12+ persisting to 13+	5	3	48	41	21	11	4	3	47	58	22	13
Acquired in 13+	6	7	18	8	20	34	5	7	18	11	22	41
TOTAL MAIN INTEREST FIELD	115	97	101	70	94	83						

B. = Boys; G. = Girls.

Inferences that have been made are :

- (1) Environment has a much greater influence than sex on the age at which interest originates in the main topics arousing the scientific curiosity of senior children.
- (2) City children seem to acquire the bulk of their main interests in science before the 11+ stage, whereas the township children seem to do so in the 12+ stage. Rural children seem to be developing more evenly over the whole age-range up to 13+ in regard to their main interests in science.

Table V gives the results of an analysis to find the proportion of main topics in science that are typical of environment. Topics were taken as typical of an environment where questions were asked only in one of the three types of environment used, or where one environment produced a number of questions that largely outnumbered those on the same topic asked in any other district.

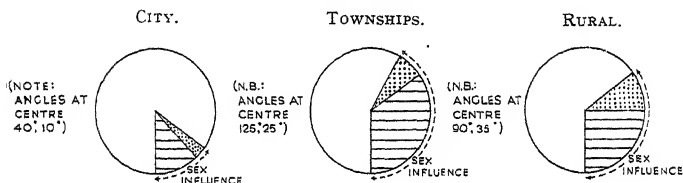
TABLE V.—MAIN TOPICS THAT TYPIFY ENVIRONMENT, 11-13+.

	City.		Township.		Rural.	
	B.	G.	B.	G.	B.	G.
Number Environment typifying Topics	14	16	2	9	3	2
Percentage of the Total Topics in Main Interest Field at 13+	12	16	2	13	3	2

The inference made is that only a small body of topics typify the environment ; in this respect, city life seems to have the greatest effect on the minds of the children.

To gain an indication of the part played by sex in deciding the main topics of interest to senior children, the main topics about which boys only in each environment asked questions were counted and taken as characteristic of boys' interest in science ; then the main topics, about which girls only in each environment asked questions, were counted and taken as characteristic of girls' interest in science ; finally, the main topics, common to both sexes in each environment, were counted. The pictograms represent the results in a pictorial fashion ; the full circle represents the whole interest-field.

PICTOGRAMS TO SHOW THE INFLUENCE OF SEX ON THE MAIN SCIENTIFIC INTERESTS OF CHILDREN.



KEY.

Characteristic
of Boys.

Characteristic
of Girls.

Common to
both Sexes.

The inferences made from the pictograms are :

- (1) The largest proportion of the main topics of interest in science to children are the common intellectual property of both sexes.
- (2) Boys seem to have the stronger bias away from this central common core of interests.
- (3) Sex influence on the main scientific interests, though small, seems to be greatest in the townships, closely followed by the rural environment ; in the city group, this influence seems to be much less evident.

VII.—SUMMARY OF CONCLUSIONS.

- (1) Boys concentrate their interests largely in the scientific field ; girls' interests are much more widespread with a definite core of scientific interests.
- (2) Biology, chemistry, mechanics, and electricity dominate the scientific interests of both sexes in the senior stage.

(3) Boys and girls are interested in the same sciences to rather similar degrees ; also, the largest proportion of main topics of interest in science to children are the common intellectual property of both sexes ; boys have the stronger bias away from the central common core.

(4) Sex influence on the main scientific interests, though small, seems to be greatest in the township and rural groups ; it is least evident in the city group.

(5) A small proportion of the main topics interesting to senior children are characteristic of an age up to 12+.

(6) Environment has a definite influence on the distribution of boys' interests between the non-scientific and scientific fields ; this does not apply to girls.

(7) The character of the kind of science in which senior children are interested is somewhat dependent on environment, particularly with rural children where there is a more concentrated interest in a fewer branches of science, compared with the more widespread interest shown in a larger number of sciences by city and township children.

(8) City children acquire the bulk of their main interests in science before the 11+ stage ; township children in the 12+ stage ; rural children develop their scientific interests more evenly over the whole age-range to 13+.

(9) Only a small body of topics can be taken as typical of environment. City life has the greatest effect in this respect.

Finally, I express thanks to Mr. Drew, Inspector of Schools for the City and County of Newcastle-upon-Tyne Education Authority ; to Mr. Paget, H.M. Inspector for the Northumberland and Tyneside Area ; and to Mr. Spink, Director of Education for Northumberland, for assistance in collecting data in the various types of environment used.

VIII.—REFERENCES.

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- ⁹ *School Science Review*, Nos. 67 and 68 ; see pp. 322, 323, 565, 568.
- ¹⁰ *Common Science* (Preface, p. v) : Washburne (Bell).
- ¹¹ *Adjusting the School to the Child* : Washburne (World Book Co., New York). See p. 111.
- ¹² *Handbook of Suggestions for Teachers* (H.M. Stationery Office, 1937), p. 486.
- ¹³ *Organisation and Curriculum of Sixth Forms in Secondary Schools* (H.M. Stationery Office, 1938), p. 56.
- ¹⁴ *Teaching of General Science* (Science Masters' Association) : John Murray, 1938, p. 18, p. 19, p. 28.

RÉSUMÉ.

LES INTÉRÊTS SCIENTIFIQUES DES ÉLÈVES DES ÉCOLES PRIMAIRES SUPÉRIEURES.

L'on recueillit et analysa des feuilles, sur lesquelles les élèves avaient écrit des questions sur des sujets sur lesquels ils voulaient se renseigner. Ces feuilles provenaient d'Écoles Primaires supérieures dans une grande ville, dans des communes, et à la campagne. L'on résume les 170 thèmes principaux de l'intérêt scientifique qui émergèrent des données ainsi rassemblées.

Le sexe exerce une influence puissante à déterminer la distribution des intérêts entre les sciences et les autres sujets, et pourtant il n'a qu'une faible influence sur les intérêts principaux en dedans du champ scientifique. Les thèmes principaux de l'intérêt scientifique appartiennent également aux deux sexes.

Le milieu a une influence non seulement sur le choix des garçons entre la science et le reste mais aussi sur le choix de la branche de la science à laquelle l'enfant s'intéresse, et pourtant il ne s'associe qu'à un petit groupe de thèmes typiques. L'âge auquel les principaux intérêts scientifiques se manifestent est également déterminé par le milieu.

Il y a relativement peu de sujets qui sont caractéristiques d'un certain âge. La biologie, la chimie, la mécanique et l'électricité sont les intérêts scientifiques les plus importants chez les deux sexes.

ZUSAMMENFASSUNG.

DIE WISSENSCHAFTLICHEN INTERESSEN VON SCHÜLERN AN SENIORSCHULEN (DER OBERN HÄLFTE DER ENGLISCHEN VOLKSSCHULE).

Kinder aus grosstädtischen, städtischen, und ländlichen Gegenden wurden aufgefordert, Fragen über Dinge zu schreiben, die sie wissen wollten.

Die Knaben hatten zum grössten Teil Interesse für wissenschaftliche Angelegenheiten; die Interessen der Mädchen waren verschiedenartiger. Doch übte das Geschlecht wenig Einfluss auf die Hauptinteressen, die auf wissenschaftlichem Gebiet lagen, aus. Die Hauptthemen wissenschaftlichen Interesses sind der gemeinsame geistige Besitz beider Geschlechter.

Die Umgebung beeinflusst nicht nur die Verteilung der Interessen der Knaben zwischen Nichtwissenschaft und Wissenschaft; sie beeinflusst auch die Zweige der Wissenschaft, wofür die Kinder Interesse haben; und doch ist sie mit nur einer geringen Zahl typischer Gegenstände verbunden. Das Alter, in dem die hauptsächlichsten wissenschaftlichen Interessen auftreten, wird auch teilweise durch die Umgebung bedingt.

Verhältnismässig wenige Themen sind charakteristisch für ein bestimmtes Alter.

A STUDY OF FACTORS USEFUL IN CHOOSING CANDIDATES FOR THE TEACHING PROFESSION.

By J. A. LAWTON.

- I.—*The problem. The selection of candidates for the teaching profession without any pre-college score of aptitude for teaching.*
- II.—*The criterion of teaching ability.*
- III.—*The connection between the criterion and*
 - (i) *academic ability ;*
 - (ii) *the non-academic school record ;*
 - (iii) *interview impressions ;*
 - (iv) *a score combining these three factors.*
- IV.—*Choice motives and success at teaching.*
- V.—*Conclusions.*
- VI.—*Bibliography.*

I.—THE PROBLEM.

WITH the passing of the student-teacher year and of the pupil-teacher system it has become almost impossible to obtain a pre-college estimate of aptitude for teaching, based on actual work in the classroom, on which to frame a forecast of the ultimate success or failure of any candidate for the profession. It follows therefore that those responsible for selecting students for the training colleges have to make their judgment on the basis of performances and attributes which are, at best, only indirectly related to teaching ability.

It must be admitted that a number of students, possibly only a small minority, do gain admission to the colleges and afterwards show themselves, for temperamental or other reasons, to be unfitted for the profession they have chosen. It may be perhaps that this minority is no larger than was the case when the criteria for admission to the colleges included a direct assessment of the teaching ability of the applicants. On the other hand the fact that some future failures are admitted leads us to enquire whether the means at present employed for discriminating between successful and unsuccessful candidates are sound or unsound.

The usual standards by which the fitness of any applicant for the profession is judged are (i) his performance at a school-leaving examination, (ii) a record furnished by the head master of his school, (iii) impressions of him formed at an interview, which because of the numbers

of those pressing for admittance, must necessarily be brief. The occasional failure of these standards may be due to the fact that there is little relation between them and the factors which make for success at teaching, or it may be that the best use is not being made of them, or it may be that the fault lies neither in the standards nor in their use, but in the fact that there is an insufficient number of those whom we would wish to see as teachers amongst the original applicant group.

The problem of gauging the effectiveness of these standards is of great importance even if the number of unsuitable persons admitted to training colleges is very small. The entry into college of those who are, for one reason or another, unfitted to teach is a matter which no one can regard with equanimity. Its importance lies chiefly in the fact that unfitness here concerns, not so much the maladjusted person himself, but the great number of children who must inevitably suffer by being placed in his charge. It is a matter of urgent necessity that anyone likely to be unfitted to teach, from whatever cause, should be prevented by every available means from entering the profession. To be fair to him, and to those who are sponsoring his career, it is imperative that he should be stayed prior to his entry into college. In facts such as these lie the importance of calling into question at frequent intervals the methods adopted for the selection of students for the training colleges.

II.—THE CRITERION OF TEACHING EFFICIENCY.

It is necessary first of all to define the standard by which fitness for the profession is to be judged. In the investigation which is to be described all the groups concerned were composed of two-year training college students and the criterion of teaching efficiency was taken to be the teaching grade awarded by the colleges to which they belonged. This mark is open to criticism on the ground that it is awarded at a stage when the person concerned is not mature and that it in no way indicates his ultimate achievement. It has been criticised too, on the score of vagueness by Professor Godfrey Thomson¹³ and others, and as representing the opinion of a small group of persons (the staff of one particular training college) by Cattell⁵. In spite of such criticisms it is still the method in common use for judging the efficiency of training college students and there is a measure of agreement amongst most training college staffs that it furnishes a reasonably reliable indication of the type of teacher the student will ultimately become. Pinsent¹¹ for example, states that "the grades used in the professional year are used largely as a basis for appointment and our experience has been that in the long run, opinions

of teaching capacity based on the grades achieved in the professional year do serve as a guide to future teaching capacity." In addition it is felt that a teaching mark, far from representing the opinion of the staff of one college only, has a value about which there is a considerable measure of agreement amongst inspectors, supervisors, head masters of practising schools and all concerned with the assessment of teaching ability.

Some slight evidence that the college grade has a certain amount of predictive value can be drawn from the following observations. A group of 67 men students were admitted to a two-year training college in the September of 1935 and were given three periods of school practice, each of one month's duration, held in December, 1935, June, 1936, and March, 1937. Only on very rare occasions did any student work under the same supervisor twice in his career, and supervisors did not know the marks which had been awarded to their students on previous practices. It is unlikely therefore that there was "halo" from one practice to the next. In addition a deliberate attempt was made to vary the conditions under which the students worked during the practices, e.g., if a student was given a junior class on one occasion he would be given a senior class on the next. The product-moment correlations between the marks given on the practices were :

<i>1st and 2nd</i>	<i>2nd and 3rd.</i>	<i>1st and 3rd.</i>
0.61 \pm 0.08	0.75 \pm 0.05	0.72 \pm 0.06

More evidence than this is necessary before any far-reaching generalisation can be made, but it does appear that the relative abilities of this particular group of students did not alter much during the period they were at college, those who were above average on entry tending to be above average on leaving, apart from any general improvement which has been effected throughout the entire body of students during their college career. It may be justifiable to assume, although it must be admitted that the evidence is somewhat meagre, that, since the relative abilities of the students tended to remain constant in college, there would also be a little change either prior to admittance or after leaving college ; in other words the better-than-average man would always be better than average at whatever point in his career the measurement was made. If this is the case then a teaching mark awarded before entry to college would be the best criterion for admittance, and the college teaching mark the best guide to future teaching ability in spite of possible exceptions to the rule.

III.—(i) THE CONNECTION BETWEEN THE CRITERION AND
ACADEMIC ABILITY.

It does not by any means follow that a brilliant student will make a good teacher. There have been many attempts in the past to trace a relationship between the factors which make for success in examinations and those which make for success in teaching. Knight⁸ found a correlation of 0.33 between normal school success and general teaching ability. Cooper⁶ with respect to 107 students found a mean square contingency coefficient of 0.332 between marks awarded for college examinations and those for teaching practice. Payne¹⁰ said that all failures in teaching in a group which he examined emanated from the lowest third of classes graduating from High School. Somers¹² found a correlation of 0.707 between the results of a college examination and an assessment of teaching ability in the first year after leaving college. More recently Pinsent¹¹ stated that he failed to find any significant connection between academic record or the abilities measured by intelligence tests and teaching grade for a group of male university students, and Turnbull¹⁴ found small contingency coefficients in groups of university students. All of these results relate to small group, of about a hundred students.

It was my good fortune to have access for a period of years, to the records of students from a group of two-year training colleges, which enabled correlations to be obtained for much larger groups than these. The examination papers were marked first of all by internal examiners and were then checked and re-assessed by external examiners common to the entire group. The teaching marks on an A to E scale were awarded first of all by the training college supervisors and then checked throughout the colleges by a group of visiting inspectors. The teaching classification provides for eleven grades. The correlation coefficients between the two sets of marks were obtained for three annual groups of students.

<i>Year.</i>	<i>No. of Students.</i>	<i>"r."</i>	<i>S.E.</i>
1932	705	0.484	0.029
1936	528	0.447	0.035
1937	497	0.457	0.036

The first significant feature which emerges from a consideration of these results is the high degree of constancy maintained from year to year. This appears to be evidence that there is considerable agreement between inspectors and supervisors with regard to the meaning and value of the marks awarded.

It is evident that there is a connection between the results of examinations and an assessment of teaching efficiency, and it is interesting to speculate on the cause of this. It is unlikely that there is pronounced "halo," good students being marked as good teachers, for whilst supervisors may in some cases know of a student's college record and be influenced by it, the inspector who is finally responsible for the award of the mark can have no such knowledge. Perhaps general intelligence is at least the part cause, although other qualities, perseverance for example, may exert an additional effect, and the actual knowledge required for success in examinations is likely to be of use in teaching.

An additional teaching mark.—The college records contained, in addition to the general teaching mark already mentioned, another mark awarded for the ability to teach physical training. It was considered worth while to obtain the correlations between the latter set of marks and the general examination marks.

Year.	"r."	S.E.
1932	0.352	0.033
1936	0.324	0.039
1937	0.300	0.036

The correlations are not so high as those obtained in the former case. This is perhaps to be expected, for, whilst it is reasonable to assume that academic knowledge and the qualities required for the acquiring of it may make a person into a better teacher of the academic subjects of the curriculum, it does not seem at all probable that these would make him into a better teacher of a non-academic subject like physical training. It may be wondered why there is any significant correlation at all, but it is very likely that there is a connection between the two sets of teaching marks; in other words a man who is able to teach the general subjects of the curriculum well will be able usually to make a reasonable success of the teaching of any single subject. The actual correlations between the two sets of teaching marks were:

Year.	"r."	S.E.
1932	0.546	0.026
1936	0.544	0.031
1937	0.500	0.034

In order to find a truer relationship between academic ability and the ability to teach physical training it is necessary to use partial correlations and to hold the general teaching marks constant.

<i>Year.</i>	<i>Partial correlation between examination mark and physical training mark when general teaching mark held constant.</i>
1932	
1936	0.103
1937	0.094

It appears then that the general teaching marks are significantly correlated with the general examination marks, whilst the physical training marks are not so correlated to anything approaching the same degree. The probable cause of this is that success as a teacher of general academic subjects depends not only upon the possession of personal qualities in the teacher which appeal to the children, but in addition the ability to assimilate and to present the taught material, and possibly a specific interest in the subject taught (indicated here perhaps by the low residual correlation). In the teaching of physical training the second of these factors is not of vital importance; if a man is interested in the subject and can handle children successfully he should make a good physical training master whatever may be his academic ability; such a man might, if his academic ability was very low, be very poor as a teacher of the ordinary subjects of the curriculum. On the other hand it is easy to see that a person academically brilliant, although well able to arrange and to present the material to be taught, might easily fail as a teacher on account of inability to "get on well" with boys.

The significance of these results then would appear to be that the academic ability of a candidate, measured by the results of an examination, will indicate his ability to arrange and to present the material for his lessons, but will not indicate the qualities which are likely to make him successful in dealing with children; other means must be adopted to estimate these.

(ii) *The school record.*—The non-academic school record of an applicant is usually taken into account in determining his suitability for the teaching profession, and it is very possible that this will afford some indication of the degree of success that he will have in the social, as distinct from the academic, aspect of teaching. It is generally assumed that a good teacher

is a natural leader, and some indication of the possession of the gift of leadership is given by the various offices, captaincies, prefectships, etc., which he may have held at school. In addition his out-of-school activities afford some clue to his interests and these in their turn may offer evidence as to his suitability. Kratz⁹, Bird², Book³, and at a later date Keilhacker⁷, have shown that the preferences of children were for teachers who possessed interests similar to their own, which means generally, interests in games, scouting, dramatic work, clubs and many other pursuits. It is possible that the possession of such interests, could a means of measuring them be found, would serve to indicate the possession of desirable teaching qualities which it has been assumed are unrelated to academic ability and therefore not indicated by examination results.

In an attempt to obtain some evidence to test the truth of this hypothesis, two groups of men students from a two-year training college were rated on an A to E scale according to the number of college activities in which they had been engaged. The marks thus awarded were correlated with each of the two teaching marks.

<i>No. of Students.</i>	<i>"r"</i> <i>With General Teaching Mark.</i>	<i>"r"</i> <i>With Physical Training Teaching Mark.</i>
72	0.23 \pm 0.120	0.66 \pm 0.080
70	0.30 \pm 0.097	0.59 \pm 0.078

Since the activities in which the students engaged, and on which therefore the marks were awarded, were chiefly outdoor games it is scarcely surprising that they correlated so highly with the marks for the teaching of physical training. Whether a score of this type would be of any use in the estimation of general teaching efficiency can hardly be decided from these results. In any case it would be an extremely difficult task to obtain such scores amongst an applicant group. The members of such a group would come from a variety of schools, with such a difference in standards that only the roughest attempts at comparison would be possible.

(iii) *Interview impressions.*—In spite of the fact that the interview is the usual method of judging the fitness of any candidate for a post it is now generally recognised that, even in the hands of an experienced interviewer, it can yield extremely unreliable results. It is doubtful whether

in the brief time available an accurate prediction of teaching ability can be made. The experiment described was performed in order to obtain a rough idea of the reliability of the interview in making such an estimate.

Groups of men students from each of three hostels were interviewed by a person experienced in the assessment of teaching efficiency. The teaching mark of each individual in each group was estimated on the usual A to E scale on the basis of an interview lasting not longer than five minutes. These marks were then correlated with marks actually obtained by the students on a teaching practice.

<i>Group.</i>	<i>"r."</i>	<i>S.E.</i>
A	0.56	0.155
B	0.51	0.166
C	0.58	0.160

The same groups were then assessed by the tutors in charge of the hostels, again all men experienced in estimating the ability of students on teaching practice. This time, however, the judgments were based, not on the conclusions drawn from a single brief interview, but on intimate knowledge extending over a period of at least a year. It happened that in one or two cases the tutor was called upon to estimate the mark of a person he had actually seen at work in the classroom. When such cases did occur they were of course omitted from the groups. The correlations between the tutors' estimates and the actual teaching marks were then obtained.

<i>Group.</i>	<i>"r."</i>	<i>S.E.</i>
A	0.80	0.100
B	0.81	0.113
C	0.67	0.145

It appears that the judgment of the first interviewer was no more reliable than if the students had been assessed solely upon the results of an examination. On the other hand the estimates made by the hostel tutors seem to indicate that a person experienced in the estimation of teaching ability should have little difficulty in making a reasonably accurate forecast of the chances of success of any applicant purely on the basis

of an intimate knowledge of him. Head masters of secondary schools should have then a good idea of the possibilities of the boys from their schools who wish to enter the training colleges. The success to be expected of forecasts based on intimate knowledge is probably due to the fact that not only is the assessor in possession of estimates of personality traits, which are all that can be expected to emerge from a brief interview, but that he can also use in formulating his final judgment his knowledge of the intellectual ability, the interests and the character qualities of the persons who are to be assessed.

(iv) *A score combining the three factors.*—Burt⁴ has shown that certain factors can be estimated with considerable success by means of the interview whilst the estimation of others is attended with considerable difficulty. If success is to be obtained in the prediction of teaching ability by means of the interview, it would perhaps be better to limit the use of the method to the estimation of traits which experiment has shown are capable of being so assessed and which are also considered to be requisite to success at teaching. There is little difficulty in deciding what traits are required by the successful teacher. Cattell⁵ has made a survey of professional opinion as to the qualities to be desired and has evolved a tentative scale "whereby head masters and others might make reports upon the prospective value of pupils intending to become teachers." In America there is a wealth of literature upon the subject, Cattell giving an extensive bibliography. In Germany, Keilhacker⁷ has attempted to discover the qualities which the children themselves would desire in their teachers. There is considerable agreement amongst all these workers as to the particular traits required for success, the lists of qualities generally including leadership, kindness, sense of humour, sympathy, tact, enthusiasm, perseverance, and self-control. Of these, perhaps judgments could be framed at an interview of leadership, sense of humour, tact, self-control and maybe enthusiasm; the remainder could only be estimated as a result of intimate knowledge.

But whilst the interview will provide estimates of certain necessary traits it has been shown to be desirable also to take into account the academic ability and the non-academic interests of the applicants, and if possible estimates of character qualities based on long acquaintance. A combined score of this type might provide a very useful guide to future teaching ability.

An attempt to obtain and to estimate the value of such a score was made in the cases of two groups of men students. A score sheet was drawn up in which the individuals were marked with respect to

several attributes considered to be necessary for teaching success. The totals assigned to each trait or performance were, it is to be feared, arrived at quite arbitrarily. The form had four main headings, the first, academic ability, was scored according to the performances of the students in a college examination. The other three were (i) traits which could be estimated at an interview, (ii) interests in non-academic pursuits, and (iii) estimates of character qualities which could only be made on the basis of fairly intimate acquaintance. The first of these was to be estimated by an interviewer after a session lasting not longer than five minutes, the second was completed by a small committee of students, and the third by the hostel tutor. The student committee did not mind estimating their fellows with respect to width of non-academic interests and activities when they were assured of the nature and purpose of the experiment.

THE COMPLETE FORM.

Name..

<i>Factor.</i>	<i>Assessed by</i>	<i>Maximum Mark.</i>	<i>Mark Obtained.</i>
I. Academic Attainment	Examination	25	
II. Voice	Interview	5	
Appearance		5	
Lucidity of Expression		5	
Brightness		5	
Interest in Affairs		5	
III. Interest in Games	Student Group	5	
Ability at Games		5	
Interest in Social Affairs		5	
Leadership Qualities		10	
IV. Sense of Humour	Hostel Tutor	5	
Kindness		5	
Tact		5	
Industry		5	
Determination		5	
Total Score		100	

It is evident from the form that the task of the interviewer has been made as light as possible, the estimation of traits such as sense of humour and tact, which might conceivably have been assessed by him, being delegated to the hostel tutor. This was done purposely for there would appear to be little chance of the interviewer making a mistake upon the five qualities which he is called upon to assess here.

The total scores obtained upon the form were correlated with the actual teaching marks awarded on school practice, the standard errors in this case being obtained by Fisher's formula.

<i>Group.</i>	<i>No. of Students.</i>	<i>" r."</i>	<i>S.E.</i>
A	45	0.70	0.076
B	45	0.82	0.049

The results appear at least to encourage the belief that could a form of this nature be completed with the same reliability prior to the admission of students to the training college as was possible afterwards, it would afford a fairly reliable means of predicting ultimate success or failure as a teacher. It must be pointed out, however, that the difficulties which would confront such an attempt are at present almost insurmountable. The diversity of school leaving examinations, for example, makes it exceedingly difficult to score the candidates relatively as regards academic attainment, whilst to attempt a relative assessment of the qualities listed in sections three and four amongst youths coming from a large number of schools, would be an almost impossible task.

IV.—CHOICE-MOTIVES AND SUCCESS AT TEACHING.

There is one further question which merits attention, that of the motives which have impelled a candidate to take up teaching as a career. It is to be feared that there is in two-year training colleges, as Professor Valentine¹⁵ and Mrs. Austin¹ have shown to be the case in University Education Departments, a 'substantial minority' who take up teaching from wrong or inadequate motives. Applicants for admission to college who may have elected to follow teaching as a career on account of the amenities it offers in the way of short hours, long holidays or regular wages are unlikely to make a success of the work to the same extent as those who have chosen it from sounder motives.

It may happen that a man possesses all the attributes which should make him into a successful teacher, but such success cannot be expected to follow automatically if his heart is not in his work. The selector therefore is faced not only with the problem of determining the suitability of a candidate, but with that of estimating the soundness of the motives which have impelled him to choose teaching as a career, a task which is in itself fraught with considerable difficulty.

V.—CONCLUSIONS.

It appears, from the results obtained, that there is a considerable measure of connection between the standards usually adopted for determining the fitness of any candidate for admission to the colleges and the teaching mark awarded at the end of the college career (which is regarded as a fairly reliable indication of future teaching ability). It must be remembered, too, that in all the cases which have been considered here, groups have been dealt with which have already been selected with respect to the standards. It is to be expected then, that correlations between these and a measure indicative of aptitude for teaching would have been considerably higher amongst the original applicant groups than was the case amongst the selected student groups. This appears to lead to the conclusion that the normal method of selection should provide a hurdle which it would be difficult for the unfitted candidate to negotiate.

That occasionally such unfitted persons do manage to effect an entry may conceivably be due to one of the following causes. In the first place it is exceedingly difficult to compare the applicants accurately with respect to the standards prior to their admission to college. That factor most easy to assess, namely academic ability, must be judged not on the basis of a single examination but on the results of a number sponsored by many different examining boards. It is almost impossible to compare candidates with respect to non-academic records and out-of-school interests, coming as they do from a large number of schools of widely differing types. It is very possible, too, that the best possible use is not at present being made of the interview. In the second place it is conceivable that there is amongst the original applicant group an insufficient number of those whom we would wish to see as teachers; in which case some colleges might be compelled to admit applicants who are nearer the border-line of success and failure than they would wish. Finally there is the difficulty of elucidating the motives which have impelled the applicant to choose teaching as a career.

The discontinuance of any form of pre-college testing period of aptitude for teaching was long urged on the grounds that such a preliminary estimate was made at too early a stage in the candidate's career to be of any real value. There is small reason to doubt that the systems then in use were open to many abuses, but there was little real evidence to show that estimates framed on such a testing period, if conducted under proper conditions, would have been as valueless as some would have had us believe. The high correlations between marks awarded on successive practices throughout the college career leads to the conclusion that an

estimate of teaching ability based on even a brief pre-college testing period conducted under the usual training college school-practice conditions might furnish the best single criterion on which to judge applicants for admission to the colleges.

The writer wishes to express his appreciation of the help and advice given to him by Dr. Wynn Jones throughout the whole of the enquiry.

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RÉSUMÉ.

UNE ÉTUDE DES FACTEURS UTILES DANS LE SÉLECTIONNEMENT DES CANDIDATS À L'ENSEIGNEMENT.

Avec la disparition de l'année de l'étudiant enseignant, et du système de l'élève-maître il n'est plus possible d'obtenir avant l'entrée à l'école normale, un pronostic de l'aptitude à l'enseignement basé sur l'observation du travail du candidat dans la salle de classe. La probabilité du succès chez un candidat qui veut entrer à une école normale doit être maintenant calculée uniquement sur les

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résultats des examens, les notes de lycée et l'impression qu'on en gagne au cours d'une entrevue.

Les résultats des expériences que l'on décrit ici tendent à démontrer qu'il y a une corrélation assez élevée entre les mesures de ces aptitudes et accomplissements et une mesure de l'aptitude à l'enseignement. Ceci mène à la conclusion que les méthodes de sélectionnement des candidats qu'on emploie ordinairement à présent sont assez efficaces, pourvu qu'on puisse obtenir des renseignements valables, et pourvu aussi qu'il y ait un assez grand nombre de candidats acceptables dans le groupe qui se présente à l'admission. En même temps l'on croit que le meilleur critère de l'aptitude à l'enseignement c'est une note donnée pour le travail pratique pendant un court stage pratique dans une école avant l'admission du candidat à l'école normale.

ZUSAMMENFASSUNG.

EINE UNTERSUCHUNG DER FAKTOREN, DIE BRAUCHBAR SIND, WENN MAN BEWERBER FÜR DIE LEHRERLAUFBAHN WÄHLEN WILL.

Nach dem Verschwinden der einjährigen Praxis für Schüler, die noch in der Schule sind, ist es nicht mehr möglich, eine Einschätzung der Lehrfähigkeit vor Aufnahme in eine höhere Schule zu ermitteln, die eine Beobachtung der Praxis des Kandidaten im Klassenzimmer zur Grundlage hat. Die Wahrscheinlichkeit des Erfolgs irgend eines Bewerbers um Aufnahme in ein Lehrerbildungsinstitut soll jetzt lediglich auf Basis von Prüfungsergebnissen, Schulzeugnissen und nach dem persönlichen Eindruck in einer Unterredung geschätzt werden.

Die Ergebnisse der geschilderten Versuche scheinen zu zeigen, dass ein ziemlicher Grad der Korrelation zwischen Masstäben dieser Eigenschaften und Leistungen und einem Masstab, der auf Lehrfähigkeit hinweist, besteht. Dies führt zum Schluss, dass die gegenwärtig allgemein angewandten Methoden um unter Bewerbern zu unterscheiden, ihre Pflicht genügend erfüllen, vorausgesetzt, dass zuverlässige Informationen vorliegen und eine taugliche Anzahl guter Bewerber sich bei der ursprünglichen Bewerber-Gruppe befindet. Gleichzeitig glaubt man, dass der beste einzelne Masstab, um künftige Lehrfähigkeit vorherzusagen, eine Lehrzensur sein würde, die auf eine kurze Praxis vor Aufnahme des Bewerbers in eine Lehrerbildungsanstalt folgen würde.

A STUDY OF THE CAREERS OF PUPILS WHO ENTER A SECONDARY SCHOOL AFTER A SECOND ATTEMPT IN THE ADMISSION EXAMINATIONS.*

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- I.—*Introduction and aim of the investigation.*
- II.—*The material.*
- III.—*A qualitative comparison of the positions in the secondary school of over 800 second "shotters" with the first "shotters" directly above and below each of them in the admission examination.*
- IV.—*A quantitative estimation of the yearly positions of the average second "shotter" compared with the average of adjacent first "shotters" at entry to the secondary school.*
- V.—*A comparison between the School Certificate and Matriculation results of neighbouring first and second "shotters" at the entrance to the secondary school.*
- VI.—*Order of merit of second "shotters" at different stages of secondary education relative to other pupils in their entry group.*
- VII.—*Conclusions.*

I.—INTRODUCTION AND AIM OF THE INVESTIGATION.

THE regulations of many educational authorities permit a child to make a second attempt in the admission examination which qualifies for entry to a secondary school. The question of whether a child who has failed at the first attempt in such an examination should be given a second chance has been a controversial topic in recent years, and at the suggestion of Professor Valentine a large-scale survey was made.

The inclusion in the secondary school of pupils admitted after their second attempt in the admission examination virtually means the exclusion of an almost equal number of younger pupils who are making their first attempt. Numerous grounds, such as different rates of mental development, ill-health, and other inevitable human factors have figured in the appeals for a second chance in the admission examination for those

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youngsters who have not done justice to themselves at their previous attempt.

It was the aim of this investigation to answer the question, " Does the child who enters the secondary school after his second attempt in the admission examination justify by his career in the secondary school the additional opportunity given him ? " If the second chance is granted we can rightly ask if such action is justified when the secondary school careers of these pupils are compared with those who have been successful first time in the admission examination and yet are, on the average, nine months younger. The importance of the problem is shown by the fact that out of 4,000 pupils who sat for the admission examination here studied, 12 per cent were making their second attempt, and that for similar examinations held in years prior to the introduction of a scheme of maintenance allowances, this figure was as high as 20 per cent. As the merits of the second " shotters " (to use an ugly but convenient term) were to be considered in relation to those of the first " shotters," the latter afford the most serviceable standard by which their progress may be gauged. To ensure reliable results, it was decided to adopt two methods of treatment, which may be briefly expressed thus :

- (1) A comparison between the yearly positions in the secondary school and the results of the School Certificate examination of pupils entering the secondary school after their second attempt in the admission examination, and pupils placed immediately above and below them in that examination in which they have made their first attempt. The second " shotters' " progress is measured by that of the first " shotters " next to them at entry.
- (2) The whole group at entry to the secondary school is to be split into three divisions of equal size. The top division, or third, will consist of the third of the whole group who are highest in the admission examination, whilst the bottom division will be the lowest third. The progress of each second " shotter " will be recorded by the division in which he is placed during each year of his secondary school career.

To accomplish these surveys, data covering the careers in the secondary school, marks in the admission examination, and the results of the School Certificate and Matriculation examinations, was collected for 1,200 second " shotters " and over 1,500 first " shotters." Owing to irregular movements of some pupils in the secondary school and the different combinations of subjects studied in the higher forms, the careers of only 800 second " shotters " warranted the desired comparative treatment outlined above.

II.—THE MATERIAL.

Printed schedules were sent to the head teachers of secondary schools asking for the following information : date of birth ; date of admission ; average age of entry group ; form entered ; order in form at the end of first to fourth years ; School Certificate result and remarks. The last item included any disturbances such as illness or transfer.

Under the heading " form entered " it was quite common to find that the new entrants were scattered over three forms, which introduced inaccuracies and some difficulties into the calculation of an individual's position relative to the whole group in which he was admitted. Naturally, numbers in any form or group fluctuate from year to year, tending to become smaller towards the higher forms of the school. This involved another difficulty, for positions of a certain pupil in unequal yearly groups are not directly comparable. For many pupils there is " a parting of the ways " after the Remove Form depending partly on the child's inclinations for the sciences or classics. With different rates of progress and promotion, specialisation, leavers and newcomers, the forms and groups will vary annually in both number and composition. In the absence of a common standard it is impossible to base judgment on the unadjusted positions of any pupil. A percentage basis was a partial solution to this difficulty, and accordingly the positions from their first term to fourth year of all pupils were re-cast. Data covering the careers of 1,200 second " shotters " and 1,500 first " shotters " had accumulated ; such figures being considered sufficiently substantial for the scope of the investigation. The average age of the second " shotters " of both sexes at the time of entry to the secondary school in September was found to be eleven years ten months. These pupils are nine to ten months older than the average child entering after the first attempt. It follows that the second " shotters " will also have had a longer preparation in the elementary school, a factor which must be corrected for in marking the papers of the admission examination.

III.—COMPARISON OF THE POSITIONS IN THE SECONDARY SCHOOL OF 800 FIRST AND SECOND " SHOTTERS."

This part of the enquiry aimed at gauging the progress of each pupil admitted after his or her second attempt in the admission examination relative to that of those directly above and below them in this examination, but who were making their first attempt. Thus, the latter serve as a standard by which one can estimate whether the average second " shotter " does better or worse than the average first " shotter " during his school

career. Such an estimate, incorporating both the school and external examinations, may be of a qualitative or quantitative nature.

In this "sandwich" method, the positions of over 800 second "shooters" were tabulated with the corresponding yearly positions of the first "shooters" immediately *above* and *below* each of them in the admission examination. Inspection of the accumulated data readily shows whether the second "shotter" gains or loses at the expense of the neighbouring first "shooters."

Further, if the numerical value of the position is utilised the degree of such gain or loss may be computed. Before dealing with details of the compilation of tables, an actual example illustrating procedure is given.

TABLE I.—SHOWING THE COMPARISON OF A SECOND "SHOTTER" WITH THE FIRST "SHOOTERS" IMMEDIATELY ABOVE AND BELOW IN THE ADMISSION EXAMINATION.

Pupil's Name.	Admission to Secondary School after 1st or 2nd attempt.	Final Order in Group at end of				
		1st Term.	1st Year.	2nd Year.	3rd Year.	4th Year.
D.K.	1st attempt	54	52	40	32	49
L.M.	2nd „	69	44	91	42	79
S.P.	1st „	68	69	79	84	85

Pupil's Name.	School Certificate and Matriculation Result.	Gain or loss of 2nd "Shotter" over 1st "Shotter."				
		1st Term.	1st Year.	2nd Year.	3rd Year.	4th Year.
D.K.	Passed S.C.	-15	+ 8	-51	-10	-30
L.M.	Failed S.C. }	- 1	+25	-12	+42	+ 6
S.P.	Failed S.C. }					

(Names in order of result of Admission Examination.)

As the size of groups varied from year to year and from school to school, all positions were first expressed as a percentage—a simple and convenient unit for comparisons. The second "shotter" (L.M.) is placed between D.K. and S.P., the first "shooters" above and below him in the admission examination. As all three remain in the same group for four years, positions may be directly compared. At a glance it will be seen that L.M. is thirty places lower than D.K. after fourth year examinations, but six places above S.P.

Fourteen schools (six being girls and eight boys) were included, and the results were summarised as shown in Table II below.

Much of the material collected could not be wholly utilised for comparative purposes for the following reasons :

- (a) The positions of some pupils were unknown as they were absent from the yearly examinations.
- (b) Pupils grouped together at entry were either placed in different forms at the onset or pursued a different type of study in the middle and higher forms of the school. Several head teachers expressed the difficulty and inaccuracy accruing from laborious attempts to recast widely differing orders to estimate positions of those in the original admission group.

RESULTS AND COMMENTS.

Table II below is a summary showing the comparison between the yearly positions of second "shooters" and the first "shooters" immediately *above* them in the admission examination.

The letters "G" and "L" refer to the numbers of second "shooters" gaining or losing places respectively at the expense of the neighbouring first "shooters." Thus, in the first line of the figures below, 272 second "shooters" do better in their first term than the first "shooters" above them at entry, whilst 218 do worse.

TABLE II.

<i>Type of School.</i>	<i>1st Term.</i>		<i>1st Year.</i>		<i>2nd Year.</i>		<i>3rd Year.</i>		<i>4th Year.</i>	
	<i>G.</i>	<i>L.</i>	<i>G.</i>	<i>L.</i>	<i>G.</i>	<i>L.</i>	<i>G.</i>	<i>L.</i>	<i>G.</i>	<i>L.</i>
8 Boys' Schools	136	106	220	219	216	210	162	155	51	62
6 Girls' ..	136	112	151	153	125	143	102	100	32	35
TOTAL . . .	272	218	371	372	341	353	264	255	83	97

First term results show that the second "shooters" of both sexes score decisively over adjacent first "shooters." Doubtless this may be largely attributed to maturity and the release from the age handicap imposed at the admission examination. After one year the second "shooters" fare, on the whole, almost exactly as well as the first "shooters" with them at the start ; 371 of them have improved their relative positions, whilst 372 occupy lower ones. This "balance" does not by itself suffice to prove equality, for the *amount* of change of position

within the group is ignored. A second "shotter" who is one place higher or lower than his neighbouring first "shotter" will, in the above mode of reckoning, count equally with one who has gained or lost fifty places. Detailed consideration of this quantitative aspect is given later in this section. Comparisons with the first "shotters" below produced results very similar to those shown in the above table. For example, the corresponding first year results were in favour of the second "shotters" by the narrow margin between 378 and 367.

In the second and third years there is almost perfect equilibrium for, if the figures be pooled, the ratio of the gains to losses of the second "shotters" are 1206 : 1208. When pupils have settled down in the school, the second "shotters" appear to fare just as well in the middle forms as the younger associates with whom they were coupled on entry. A margin of two in over 1200 supports the earlier suggestion that age, though of aid at the onset, becomes rapidly less influential with time. In their fourth year the second "shotters" of both sexes "lose ground" compared with the first "shotters" above and below them at entry. The advantage of age seniority has now vanished entirely and there remains a small balance in favour of the first "shotter." It will be noticed that in the first year results over 700 second "shotters" were used for the comparison, whereas in the fourth year the number had shrunk to under 200, which would certainly reduce the degree of reliability. The differences between the comparisons of the same second "shotter" with the first "shotters" above and below are as slight as those in the admission examination. Throughout the second "shotters" do slightly better relative to the first "shotters" below than above them, a conclusion which one might have conjectured from their intermediate position.

No deviation from the above conclusions is found if the sexes are segregated, for in both cases the second "shotters" lead at the lower part of the school; just "hold the course" in the middle forms; but are not quite so good in the higher forms and external examinations.

Owing to departures, absences, different courses of study, the number of pupils included in this part of the enquiry dwindled considerably in the very years upon which evidence was particularly desired. Extensive trustworthy information was required for the end of the pupil's school career, and therefore more attention must be given to the academic results in the fourth year and external examinations, for unfortunately they are still by many regarded as the criterion of success and attainment. The final small, but "all round" advantage in favour of the first "shotters" by no means suffices to condemn the calibre of the second "shotters," or to warrant any general modifications in the existing admission examination régime.

IV.—A QUANTITATIVE ESTIMATION OF THE YEARLY POSITIONS OF THE AVERAGE SECOND "SHOTTER" COMPARED WITH THE AVERAGE OF THE ADJACENT FIRST "SHOTTERS" AT THE ENTRY TO THE SECONDARY SCHOOL.

The few paragraphs included under this heading are a supplement to the preceding section inasmuch as the extent of gain or loss of the average second "shotter" relative to the first "shotters" above and below has been investigated. The positions in the group of the pupils to be compared were expressed as a percentage before the average gain or loss of the second "shotter" was computed.

On the right-hand side of Table I, it will be seen that in a group of 100 the second "shotter" (L.M.) is placed lower than D.K., who was the first "shotter" above him in the admission examination. A case in which thirty-one comparisons were made might be quoted as an example. The thirty-one second "shotters" were each placed beside first "shotters" above them on entry. After expressing their positions as a percentage, the sum of the gains between yearly examinations totalled 146, whilst the corresponding losses were 169. The average loss per pupil was, therefore $\frac{169 - 146}{31} = .76$. In the table this is recorded as -1 , which

interpreted, means that in a group of 100 the average second "shotter" will be about one place or 1 per cent lower than that of the first "shotter."

In compiling the tables below, variations naturally occurred within a school as well as from school to school. This forbids value to be attached to a single result. Pooling the results of fourteen schools for four years gives a more acceptable value, for in the summation of 434 averages, extremes will tend to cancel out.

TABLE III.—SHOWING THE AVERAGE PERCENTAGE GAIN OR LOSS IN POSITIONS FOR SECOND "SHOTTERS" IN RELATION TO ADJACENT FIRST "SHOTTERS."

(a) COMPARISON OF SECOND "SHOTTERS" WITH FIRST "SHOTTERS" *above* THEM AT THE ADMISSION EXAMINATION.

	1st Term.	1st Year.	2nd Year.	3rd Year.	4th Year.
Average for Boys and Girls ..	+3.26	+1.44	+ .27	+ .87	-3.63
Average for Boys	+3.42	+ .77	+1.81	- .50	-3.94
Average for Girls	+3.06	+2.52	-1.78	+2.31	-3.09

(b) COMPARISON OF SECOND "SHOOTERS" WITH FIRST "SHOOTERS" below THEM AT THE ADMISSION EXAMINATION.

	1st Term.	1st Year.	2nd Year.	3rd Year.	4th Year.
Average for Boys and Girls ..	+5.44	+ .14	+ .21	- .31	-2.27
Average for Boys	+6.79	- .76	+ .93	-2.21	-2.33
Average for Girls	+3.73	+1.57	-1.00	+2.89	-2.18

In the above it is seen that the second "shooters" gain progressively diminishes in size and in the fourth year has been converted into a loss equal to the initial advantage. This applies to both sets of comparisons, and generally to both sexes. The second "shooters" naturally do better when compared with the first "shooters" below them than with those above.

Changes of considerable magnitude mark the "upheaval" between entry positions and those of the first term and first year, and contrast with the small gradual transition witnessed in later years. Such an inference has already resulted in the previous section, and clearly shows that the age seniority on the side of the second "shotter" is operative in the first term and first year results. The abnormality in the first term average for the boys in Table IV(b) is partly due to four schools being unable to supply the data and thus materially reducing numbers on which averages were based.

In the fourth year the second "shooters" of both sexes are lower than the corresponding first "shooters" above and below them at the onset. This general backwardness at the close of school days of the average second "shotter" compared with his more youthful fellow entrants is an important conclusion from this analytical study for, in making degree rather than the number of gains or losses the vital factor, the many bare successes of second "shooters" are kept in true proportion and perspective.

An initial advantage, a "neck-to-neck" struggle leading to a slight final "lag" at the end of the race, expresses the academic progress in the secondary school of the average second "shotter" when compared with the average first "shotter" with whom he was coupled on admission.

V.—SCHOOL CERTIFICATE AND MATRICULATION RESULTS OF NEIGHBOURING FIRST AND SECOND "SHOOTERS."

The School Certificate and Matriculation examinations, being external to the school, serve as an invaluable additional standard by which the merits and demerits of first and second "shooters" may be

judged. Strict comparison is not legitimate here, for many were the numbers and combinations of subjects taken by those to be compared, and though such groupings of subjects would align with the attainments and interests of individual pupils in them, results would certainly differ considerably without a choice of subjects. As with the admission examination, the "luck of the paper," ill health, and other inevitable external factors are still influential.

The important point is what proportion of second "shotter" entrants gain School Certificates in their fourth year as compared with the first "shotters" who were their immediate neighbours in the entrance examination.

Four hundred and fifty-one neighbouring "pairs" of first and second "shotters," who entered the secondary school at the same time, gave the following interesting results, though some of them were not entered for the School Certificate examination.

TABLE IV.

<i>Number and Type of Pupils at entry to the Secondary School.</i>	<i>Number and Percentage gaining School Certificate in their 4th Year.</i>	<i>Number gaining Matriculation.</i>	<i>Number gaining Higher School Certificate.</i>
451 First "Shotters"	221 (49%)	96 (21.2%)	14 (3.1%)
451 Second "	161 (35.7%)	59 (13.1%)	7 (1.5%)

Whilst the School Certificate results only refer to those taking the examination in their fourth year, the Matriculation and Higher School Certificate results naturally include subsequent years. Each of the 451 first "shotters" was ranked next in the entrance examination to a second "shotter" with whom each was compared, though no distinction was made between those first "shotters" who were above and those who were below the neighbouring second "shotter."

The above School Certificate results show the unquestionable superiority of the first "shotters," and if the Matriculation and Higher School Certificate figures are perused, the relative gain is even greater. We know that the second "shotters" are, on the average, nine to ten months older than the average age of the first "shotters," and have also noted a distinct "lag" on the part of the second "shotters" in their fourth year. Such factors partially account for these very conspicuous differences.

As further evidence, the average School Certificate results of 1,136 first "shotters" and 508 second "shotters" who completed a four-year course in the secondary school might be quoted.

TABLE V.

<i>Number and Type of Pupils entering the Secondary School.</i>	<i>Number of these Pupils gaining :</i>		
	<i>School Certificate.</i>	<i>Matriculation.</i>	<i>Higher School Certificate.</i>
1136 First "Shotters".	577 (50·8%)	262 (23%)	51 (4·4%)
508 Second " "	171 (33·6%)	66 (12·9%)	8 (1·5%)

These results, based on considerably larger numbers, though not comparable as their distribution in the entry order to the secondary school would differ, substantiate conclusions made above.

Summarizing, it is noted that the "lag" of the second "shotters" in their fourth year behind the first "shotters" with whom they were coupled on entry, is reflected to an even greater extent in the School Certificate examination. Out of 451 "pairs" of neighbouring entrants, 49 per cent of the first "shotters" have obtained a School Certificate in four years, yet only 35·7 per cent of the second "shotters" have achieved this. In the Matriculation and Higher School Certificate examination the "gulf" is wider still. After School Certificate stage the age seniority will mean that there will be more leavers among second "shotters" than among the first "shotters."

VI.—ORDER OF MERIT OF SECOND "SHOTTERS" AT DIFFERENT STAGES OF SECONDARY EDUCATION RELATIVE TO OTHER PUPILS IN THEIR ENTRY GROUP.

Success of the second "shotter" has been estimated by his performance relative to neighbouring first "shotters" and will now be gauged by using the other members of the group in which he is placed as a standard. Thus essentially the standard by which the second "shotter" is adjudicated has widened from the single first "shotter" to the group of which both are members. The whole admission group is divided into three divisions or compartments of equal size, the top division will consist of the third of the pupils who are highest in the mark list, and the bottom division is composed of the third who are lowest. To obtain a correct perspective of the secondary school careers of second "shotters" three tabulations were necessary :

- (a) Where the pupils were graded according to their order in the admission examination ; such order being compared with the respective yearly examination within the secondary school. Variations in the size of the originally equal divisions give an

indication of the movement which takes place between the admission examination and periods in the secondary school, and should substantiate or contradict later findings on the degree of prognostication of the admission examination.

- (b) The pupils are graded from their order in the secondary school after one year ; such order being compared with those of later years. The stability within the secondary school, after allowing the pupils a year in which to become "acclimatized" to the new régime and surroundings is here the claimant to our attention.
- (c) Employing the School Certificate and Matriculation examinations as a rough gauge of success in the secondary school, the results of these are classified according to the division into which each of the second "shotters" was placed on entry, and after one year in the secondary school.

This extends (a) by linking the admission and School Certificate examinations between which is the period of secondary education. In addition (b) is further developed by comparing an early school order with that of an external examination taken three years later.

MATERIAL, METHOD, RESULTS AND CONCLUSIONS.

Each second "shotter" was placed on entry to the secondary school into the top, middle or bottom third or division, and the careers of those in each of such divisions has been separately studied.

If the total number in the admission group was 150, then all second "shotters" whose placings were between one and fifty are assigned to the top third, and similarly the bottom third claimed those occupying positions between 100 and 150.

TABLE VI.—THE DIVISION OF THE WHOLE ENTRY GROUP INTO THIRDS, SHOWING THE POSITIONS OF 508 SECOND "SHOTTERS" FROM ADMISSION TO THE FOURTH YEAR IN THE SECONDARY SCHOOL.

<i>Division of Group into Thirds.</i>	<i>Number in each Division after :</i>				
	<i>Entry.</i>	<i>1st Year.</i>	<i>2nd Year.</i>	<i>3rd Year.</i>	<i>4th Year.</i>
Top Third	117	163	156	162	150
Middle Third	167	190	211	193	197
Bottom Third . . .	224	155	141	153	161
TOTAL	508	508	508	508	508

It will be seen that of the 508 second "shooters" studied, 117 were in the top third of the entry group, 167 in the middle third, and 224 in the bottom third. That the largest number of second "shooters" at entry to the secondary school were in the bottom third indicated a slight initial disadvantage compared with their fellow entrants.

When the same second "shooters" are recast again relative to the whole of their entry group, but after their first year examinations in the secondary school, they show considerable improvement, the number in the top third having increased by 40 per cent, whilst the decrease in the bottom third is over 30 per cent. Second, third and fourth-year figures show that this advantage does not last, and that the brighter younger pupils steadily gain on the less bright older ones. The defect of the above method of classification is that no indication is given of the movements of individual pupils during their secondary school careers. As an example, it may be asked how are the 117 second "shooters" in the top third of the entry group actually distributed after their first and subsequent years of secondary education. It is only to be expected that some will be relegated to lower divisions or lower positions within the same division. It is equally important to know how many of the 224 in the bottom third at entry will have climbed to the top third after four years, and also the number who continue to occupy the lowest positions.

TABLE VII IS DESIGNED TO SHOW SUCH MOVEMENTS OF THE ABOVE 508 SECOND "SHOOTERS."

<i>Division of Group into Thirds.</i>	<i>Number in each Division classified from Entry Order.</i>				
	<i>Entry.</i>	<i>1st Year.</i>	<i>2nd Year.</i>	<i>3rd Year.</i>	<i>4th Year.</i>
Top Third	117	64 (T.) 35 (M.) 18 (B.)	63 (T.) 41 (M.) 13 (B.)	66 (T.) 37 (M.) 14 (B.)	64 (T.) 32 (M.) 21 (B.)
Middle Third	167	49 (T.) 69 (M.) 49 (B.)	57 (T.) 65 (M.) 45 (B.)	60 (T.) 64 (M.) 43 (B.)	48 (T.) 75 (M.) 44 (B.)
Bottom Third ..	224	50 (T.) 86 (M.) 88 (B.)	36 (T.) 109 (M.) 79 (B.)	36 (T.) 92 (M.) 96 (B.)	38 (T.) 90 (M.) 96 (B.)
WHOLE GROUP TOTAL	508	508	508	508	508

(The letters T, M and B refer to the top, middle and bottom thirds in which the pupils were placed.)

Sixty-four of the 117 pupils assigned to the top third at entry still remain in that category after their first year in the secondary school, the remainder being divided between the middle and bottom thirds. The consistency of the distribution of these better pupils after they have settled down in their new school cannot escape notice. The fourth year figures (64 top third, 32 middle third, and 21 bottom third) is almost identical with the distribution in the first year (64 top third, 35 middle third, and 18 bottom third). Such figures clearly indicate that the majority of second "shooters" who rank highest in the entry order to the secondary school are those who benefit most from the secondary school course.

Of those originally placed in the bottom third, only 16 per cent climb ultimately to the top third, the remainder failing to make any substantial progress relative to other members of their group—a result shortly to be justified by School Certificate results. It would be very unjust to condemn all pupils placed in the lowest third, for inquiry into the vocations and careers of some of these "plodders" shows that some of them make enormous strides after leaving school, and meet with success in the examinations of professional bodies.

If order of entry is the criterion of classification, the second "shooters" have a relative advantage after the first year in the secondary school. This lacks permanence and at the end of school days the second "shooter" is below the standard of the average first "shooter." If the internal order of the pupils in the secondary school after one year be made the basis for classification, the uncertain variables associated with the admission examination and the early but peculiarly evanescent upheaval of the first year, are eliminated. Appropriately this forms the subject matter of the next section.

THE MOVEMENTS OF 508 SECOND "SHOOTERS" IN THE SECONDARY SCHOOL AFTER CLASSIFICATION FROM FIRST-YEAR ORDERS.

It will be agreed that after one year in the secondary school the average child will have become accustomed to the régime of the new environment, and that the first annual examination should be a fairly reliable basis for grading if it is desired to trace the secondary school performance of certain groups of pupils.

In the previous section it has been clearly shown that early fluctuations are definitely evanescent by the close of the first year, which must, therefore, be a surer starting point. The 508 second "shooters" were each allocated to either the top, middle, or bottom thirds as justified by their positions after one year.

TABLE VIII.

Division of Group into Thirds.	Number in each Third, being classified from 1st Year Order in the Secondary School.			
	1st Year.	2nd Year.	3rd Year.	4th Year.
Top Third	163	121 (T.) 39 (M.) 3 (B.)	117 (T.) 37 (M.) 9 (B.)	107 (T.) 42 (M.) 14 (B.)
Middle Third	190	26 (T.) 129 (M.) 35 (B.)	38 (T.) 115 (M.) 37 (B.)	31 (T.) 108 (M.) 51 (B.)
Bottom Third	155	9 (T.) 43 (M.) 103 (B.)	7 (T.) 41 (M.) 107 (B.)	12 (T.) 47 (M.) 96 (B.)
WHOLE GROUP TOTAL	508	508	508	508

Out of the 163 pupils credited to the top third after one year in the secondary school, 65 per cent of them are still there after four years, whilst the corresponding percentage for the bottom third is 62 per cent. As an expression of consistency within the school, these figures are positive, and, when all the disturbing factors are considered, they are relatively high. If the analysis be perused more carefully, it will be seen that from the top third there is a slight yearly increase in the numbers relegated to the middle and bottom thirds, but that this is offset by promotions from the lower thirds. In drawing together material for the table, the cases of pupils who in one year were just in one division or third and outside it next year, only narrowly to return in the following year, were common. Such movement, though actually small and not recorded for those around the median of their division, influences the figures of the table.

The middle third provides an almost equal proportion of members for the top and bottom thirds, the latter receiving a larger number in the fourth year. Both the middle and top thirds show a larger quota for the bottom division in the fourth year. *It appears both from the table and study of individual second "shooters," that these pupils tend to "slow-up" or "tire" after the third year—an effect seen both in the School Certificate examination as well as the fourth yearly school tests.*

SCHOOL CERTIFICATE AND MATRICULATION RESULTS OF 508 SECOND "SHOTTERS" WHO WERE CLASSIFIED FROM THE ADMISSION EXAMINATION AND FIRST-YEAR ORDER IN THE SECONDARY SCHOOL.

The primary aim here is to trace the performance of each second "shotter" in the School Certificate examination relative to the one of the three divisions in which he or she was placed on admission and after one year in the secondary school.

The preceding conception of the three divisions or groups of equal size, in which position or order of merit is the determining factor for constituents, is again employed. The following table summarizes the fortunes in the leaving examination of 508 second "shotters" who were graded into top, middle, or bottom divisions after one year in the secondary school.

TABLE IX.—SCHOOL CERTIFICATE RESULTS FOR SECOND "SHOTTERS" CLASSIFIED FROM FIRST-YEAR SECONDARY SCHOOL ORDER.

Division of Groups into Thirds.	Number of Pupils after one Year.	Number of such Pupils gaining :		
		School Certificate.	Matriculation.	Higher School Certificate.
Top Third	163	93 (=57%)	46	6
Middle Third	190	57 (=30%)	14	1
Bottom Third	155	21 (=14%)	6	1
TOTAL	508	171	66	8

The top third secures 54 per cent of all the School Certificates, and 69 per cent of the total Matriculation Certificates. On the other hand, the bottom third can only claim percentages of twelve and nine respectively. From this and previous researches¹, we know that after one year in the secondary school, pupils are "settling down" and their positions even at that stage bear high correlations with those of later years. *The inequality of distribution shows that the second "shotters" who are highest in the lower forms of the school will form the nucleus of the successes in the external examination at the termination of the school career.*

A single year in the secondary school gives a reliable indication of attainment three years later, and at this early stage many pupils found to be unsuited to one type of secondary education could be profitably transferred to a school offering a more appropriate type.

¹ See *The Reliability of Examinations*, by C. W. Valentine, p. 87.

In two groups of equal size the ratio of passes in the School Certificate examination is no less than 57 to 14, from which it appears that for many in the bottom division after one year in the secondary school, a return to the senior elementary school or technical school, as recommended by the Hadow Committee should, in the interests of the individual pupil and the taxpayer, receive immediate consideration.¹

TABLE X.—SCHOOL CERTIFICATE RESULTS OF SECOND "SHOTTERS" CLASSIFIED FROM ORDER OF ADMISSION TO THE SECONDARY SCHOOL.

Division of Group into Thirds.	Number of Pupils at Admission.	Number of such Pupils gaining :		
		School Certificate.	Matriculation.	Higher School Certificate.
Top Third	117	57 (=49%)	27 (=23%)	5
Middle Third	167	61 (=36%)	19 (=11%)	1
Bottom Third	224	63 (=28%)	20 (= 9%)	2
TOTAL	508	171	66	8

Though numerically the School Certificate "spoils" are divided almost equally between the three groups, it will be noted that the bottom third includes almost twice as many second "shooters" as the top one. A truer perspective is obtained when the School Certificate results are expressed as percentages, for this shows that only one in four of those in the bottom third at entry will obtain a certificate, and less than one in ten will matriculate.

However, examinations must not become the "idols" for us to appease, for many of the life values accruing from secondary school education are not recorded in examinations, and aptitude in one direction may be a positive hindrance rather than an asset in satisfying the general requirements of to-day.

VII.—SUMMARY OF RESULTS AND CONCLUSIONS.

(1) As roughly 12 per cent of the candidates sitting for the secondary school admission examination were making their second attempt, it is reasonable to expect that those of them who receive secondary education should justify in the school and external examinations this additional opportunity.

¹See *Report on the Education of the Adolescent* by Consultative Committee appointed by Board of Education, Chapter III, Para. 97 ; and Chapter VII, Para. 156.

(2) Those who enter at their second attempt are on the average nine months older than those admitted at the first attempt. This seniority in age and the consequent longer period of preparation in the primary school gives the younger first "shooters" an age allowance in the admission examination, but not in the examinations in the secondary school.

(3) The average position in the entrance examination gained by the second "shooters" is far below that of the first "shooters." If the order of merit of all pupils who enter the secondary school is divided into three equal groups, there are nearly twice as many second "shooters" in the bottom group as in the top group.

(4) Information concerning the secondary school careers of 1,200 second "shooters" and 1,500 first "shooters" was collected, but owing to irregular movements of pupils in the secondary school and the different combinations of subjects studied, the careers of only 800 second "shooters" could be used for comparison with the first "shooters" immediately above and below them at the admission examination. At the end of the first term and first year in the secondary school the second "shooters" on the average gained in position. The absence of the age "handicap" imposed in the admission examination, together with the extra nine months in the primary school, will largely account for this.

(5) There is little to choose between first and second "shooters" in the middle forms of the secondary school, though in their last year there is a pronounced "lag" on the part of the second "shooters," and is well shown by an extract from a table :

AVERAGE NUMBER OF PLACES LOST BY THE SECOND "SHOOTERS"
BY THE END OF THE FOURTH YEAR.

(a) Compared with first "shooters" immediately	}	Boys	3·94
above them at admission		Girls	3·09
(b) Compared with first "shooters" immediately	}	Boys	2·33
below them at admission		Girls	2·18

(6) The superiority of the first "shooters" is confirmed when reference is made to external examinations. Out of 451 pairs of neighbouring first and second "shooters" at admission, 49 per cent of the former have secured a School Certificate after four years, but only 35·7 per cent of the second "shooters" have achieved this. The corresponding percentages for Matriculation were 21 and 13.

(7) A comparison between the School Certificate results and the order of merit of the second "shooters" on entry, and after one year

in the secondary school, cannot but arouse thought on the question of the advisability of a review of the progress of each individual in the early stage of secondary school life. When the entry group is divided into thirds it is found that there are almost twice as many second "shooters" in the bottom third as the top one, yet of the latter 49 per cent secures School Certificates compared with 28 per cent for the former. Fifty-seven per cent of the 163 second "shooters" in the top third at the end of one year get School Certificates. The corresponding percentage for the 155 in the bottom third is only 14 per cent.

(8) Generally it may be said that the second "shooters" are slightly below the first "shooters" in the admission examination. They improve their positions in the first year of secondary school life, being freed from the handicap of age allowance. At the end of four years they are about three places lower in class than their neighbours at entry, and successes in the School Certificate and Matriculation examinations are not so numerous. On the other hand it must be pointed out that the results in these examinations for those second "shooters" who were in the top third of the admission list were almost equal to those of pupils who entered the secondary school after their first attempt. For these pupils a second attempt to enter the secondary school is justified by results.

RÉSUMÉ.

UNE ÉTUDE DE LA CARRIÈRE DES ÉLÈVES QUI ENTRENT À UNE ÉCOLE SECONDAIRE APRÈS LEUR SECOND ESSAI À L'EXAMEN D'ADMISSIBILITÉ.

12% de 4,000 élèves se présentant à un Examen d'Admissibilité en étaient à leur second essai. Le but de la recherche était de tracer la carrière de tels élèves à l'École Secondaire et au "School Certificate Examination."

L'on établit une comparaison entre 800 élèves admis à leur second essai et les élèves voisins au-dessus et au-dessous d'eux, mais qui entrèrent à l'École Secondaire après leur premier essai. L'on trouva que ceux-là gagnent au dépens de ceux-ci pendant le premier trimestre et la première année dans l'École Secondaire. Cet avantage était dû en grande partie au fait qu'ils étaient plus âgés de neuf mois que ceux avec lesquels on les comparait; de plus, ils n'étaient pas, dans l'École Secondaire, pénalisés à cause de leur âge comme dans l'Examen d'Admissibilité. A la fin de leur carrière scolaire ils ne réussissaient pas tout à fait aussi bien, et dans les examens du lycée, et dans les externes, que les élèves plus jeunes à qui ils étaient associés à l'entrée.

Les résultats semblent justifier le second essai à l'Examen d'Admissibilité, des élèves inaptes découverts après une année dans l'École Secondaire devraient être transférés à un type d'école qui leur conviendrait mieux.

ZUSAMMENFASSUNG.

EINE UNTERSUCHUNG DER LAUFBAHNEN VON SCHÜLERN, DIE BEIM ZWEITEN VERSUCH DER AUFNAHMEPRÜFUNG DIE HÖHERE SCHULE BEZIEHEN.

12 v.H. von 4,000 Schülern, die eine Aufnahmeprüfung versuchten, machten schon ihren zweiten Versuch. Die Untersuchung sollte die Laufbahnen solcher Schüler in der höheren Schule und in der School-Certificate-Prüfung verfolgen.

Man machte einen Vergleich zwischen 800 Schülern, die nach ihrem zweiten Versuch bei der Aufnahmeprüfung aufgenommen wurden, und denen, die gerade über und unter ihnen in der Prüfung abschnitten, die aber nach ihrem ersten Versuch die höhere Schule bezogen. Man stellte fest, dass die ersteren Vorteile erlangen auf Kosten der letzteren während des ersten Semesters und des ersten Jahres in der höheren Schule. Diese Vorteile sind grösstenteils auf die Tatsache zurückzuführen, dass sie neun Monate älter waren als diejenigen, mit denen sie verglichen wurden; auch in der höheren Schule wurden sie nicht durch verschiedenes Alter behindert wie in der Aufnahmeprüfung.

Am Ende der Schulzeit erzielten sie etwas weniger Erfolg sowohl in der Schule als bei Prüfungen ausserhalb der Schule, als die jüngeren Schüler, mit denen sie zusammen eintraten.

Die Ergebnisse scheinen den zweiten Versuch bei der Aufnahmeprüfung zu rechtfertigen; ausgesprochene "Versager," die nach einem Jahr in der höheren Schule entdeckt werden, sollten einem geeigneten Schultyp zugeführt werden.

THE BEARING OF GENERAL AND SPECIAL ABILITIES UPON SCHOLASTIC SUCCESS AT THE BEGINNING AND END OF A SECONDARY SCHOOL CAREER.*

BY MARY ORMISTON.

PART I: JUNIOR CHILDREN.

- I.—*Introduction : the problem.*
- II.—*The preliminary work.*
 - (i) *The tests used.*
 - (ii) *The analysis of the preliminary results.*
- III.—*The main experiment.*
 - (i) *The Junior Group.*
 - The analysis of the results of the Junior Scholarship examinations in Districts A and B.*
 - The analysis of the tests involving the spatial factors.*

I.—THE PROBLEM.

At the present time the scholarship examination, taken by pupils of ten or eleven years of age, is an important means of deciding fitness for secondary education. After satisfying this first criterion, pupils embark on a four or five years' course, at the end of which they are judged by a second criterion of success such as the School Certificate or some similar examination.

In the hands of well-organised authorities these two criteria may, perhaps, be regarded as the best available measures of success at the beginning and end of the secondary school career.

The aim of this research was to find the bearing of general and special abilities upon these two examinations.

II.—THE PRELIMINARY WORK.

- (i) *The tests used.*

A considerable amount of preliminary work had to be done in order to obtain tests of general and special abilities from which the analysis could be undertaken.

* Based upon a thesis approved for the degree of Ph.D. in the University of Leeds.

Evidence of both general and special factors has been found in tests already published, and some of these tests formed the basis for the first battery. Verbal and non-verbal tests for g , tests for a number, verbal, and spatial factor were made on similar lines to those used in previous work, where such factors had been traced.

The following twenty tests were ultimately formed or selected and applied to 100 elementary school children of ten and eleven years of age: Mechanical Arithmetic¹, Non-Mechanical Arithmetic², Verbal Analogies, Verbal Classification³, Logical Selection⁴, Opposites⁵, Verbal Imagery⁶, Finnish Words Test⁷, German Words Test, Non-Verbal Analogies⁸, Non-Verbal Classification⁹, Correlate Education¹⁰, Dot Pattern Perception¹¹, Overlapping Shapes¹², Paper Cutting¹³, Spatial Symbols¹⁴, Paper Formboard¹⁵, Spatial Imagery¹⁶, the Passalong Test¹⁷, and a Tracing Test. In this Tracing Test the children were required to trace two figures. They were told that they would be marked for accuracy *and* for the amount of the figure completed. The figures were divided into sixty sections, and the number of sections completed to the required standard of accuracy was then divided by the number of sections finished, and thus their final score was obtained. These results were correlated with the estimates of 'persistency' given by the teachers ($r = .49$ P.E. .04).

A similar battery of tests was prepared for children of fifteen years of age. In so far as was possible these tests were made comparable to those used for the younger children, the same fundamentals being involved in each test respectively. The time allowed and the difficulty of the items were adjusted to obtain a satisfactory distribution of marks. The Passalong Test was not used with the older children, because of the length of time needed to administer this individual test.

(ii) *The analysis of the preliminary results.*

From this analysis it was hoped to find the factor loadings of the tests used, and ultimately to find tests highly loaded with the factors

¹ and ² Based on the work of COLLAR : *Brit. Jour. Psych.*, 1920 ; and FOURACRE : *The Forum of Education*, iv. 3, 1926.

³, ⁴ and ⁵ After TOMLINSON'S West Riding tests.

⁶ After L. WYNN JONES : *Introduction to the Theory and Practice of Psychology*, p. 58.

⁷ There was some similarity of form between the German and English equivalents, but not between the Finnish and English.

⁸, ⁹, ¹⁰ and ¹¹ After the tests of EL. KOUSEY : *Brit. Jour. Psych.*, Mon. Supp. xx.

¹² After STEPHENSON : *Brit. Jour. of Educ. Psych.*, 1931.

¹³ After BINET'S Paper Folding test.

¹⁴ After ORMISTON : *Geography*, vol. xx, pt. iii, 1935.

¹⁵ and ¹⁶ Published by Stoetling and Co., Chicago.

¹⁷ ALEXANDER : *Brit. Jour. Psych.*, 1932.

detected which would be sufficiently pure tests of these same factors as to serve as axis tests for rotations for the respective factors.

The loadings of the general factor in the tests used was first found. The Spearman¹ method was applied for this purpose. The tests of Non-Mechanical Arithmetic, Verbal Analogies, Paper Formboard, and Non-Verbal Classification were together used as reference values, since their intercorrelations with the battery was large, while the overlap as shown in the specific links between the tests was low.

The *g* loadings obtained thus are given below :

	<i>g</i> loading.
(1) Paper Folding	·420
(2) Passalong	·204
(3) Correlate Education.....	·456
(4) Spatial Imagery	·667
(5) Verbal Imagery	·681
(6) Non-Mechanical Arithmetic	·824
(7) Mechanical Arithmetic	·482
(8) Finnish Words.....	·239
(9) German Words.....	·198
(10) Opposites	·726
(11) Verbal Logical Selection ..	·632
(12) Verbal Classification	·660
(13) Verbal Analogies.....	·886
(14) Dot Pattern Perception....	·436
(15) Overlapping Shapes.....	·413
(16) Non-Verbal Analogies.....	·581
(17) Paper Formboard	·859
(18) Spatial Symbols	·476
(19) Non-Verbal Classification ..	·762

The *g* loadings obtained by the Thurstone method of analysis differed from the above only in detail.

It seemed, therefore, that Verbal Analogies was the best single test of *g*, its loading being ·886, and it was used as the *g* axis in the later analysis.

After taking out this *g* factor, a factor of some size followed in the Mechanical Arithmetic Test. This factor was present also in the Non-Mechanical Arithmetic Test, and yet it was not significantly present in the other tests. This evidence, together with that of reports of other investigators, pointed to this being a number factor. The test of Mechanical Arithmetic was loaded with it to the extent of ·459, the *g* loading of the test being ·490. This test was adopted for the axis of the *n* or number factor.

¹ SPEARMAN : *The Abilities of Man*, Ap. xvi.

A further factor was found common to all the verbal tests, independently of whether they involved memory, imagery or speed, yet this factor was not significantly present in the non-verbal tests. In the light of previous¹ work this factor was taken to be verbal. The loadings of this factor were high in the Finnish and German word tests. The Finnish test was chosen for the *v* axis.

The tests of logical selection, classification, and opposites were loaded to the extent of .346, .259, and .251 with another factor, which was not present in the other tests used. In view of previous work, it seemed most probable that this was a factor involving a special logical ability, and it was decided to use the logical reasoning test as an axis for this factor. Unfortunately this test had to be discarded in the final investigation as it entailed a considerable amount of time—(and if the time had been shortened the items involved would have been too few to warrant many conclusions)—the length of testing time being strictly limited in the final groups of children.

A factor common to all the spatial tests, including the Passalong Test, with the exception of Overlapping Shapes, was also detected. The factor was present even in such tests as Non-Verbal Classification, where little scope for spatial imagery was given. It was at its greatest in the Paper Formboard Test, where it was .326, and this test was selected for the axis for this factor in the later work. This factor has been termed the spatial factor or S_1 .

Still another factor was common to the Spatial Imagery, Verbal Imagery, and Paper Folding tests, its loading being the greatest, .379 in the test of Spatial Imagery. It would seem reasonable to interpret this factor as one involving Imagery. The Spatial Imagery test was used as the axis for this factor in the later work, and this factor has been signified by S_2 .

From this analysis, tests which could be used for the *g*, *n*, *v*, S_1 , S_2 , and logical factors were obtained. The factorial make-up of these tests was ascertained and further, it was found that within the variations of age to be tested (i.e., ten to eleven years, and the School Certificate children of fifteen to sixteen years of age) there was no significant correlation with age.

III.—THE MAIN EXPERIMENT.

The subjects.—It was thought desirable to have a variety of types of schools and districts from which the children were drawn to prevent

¹ STEPHENSON : *Journal of Educ. Psych.*, 1931.

such a factor as locality influencing the results. Children from boys', girls', and mixed schools were included, drawn from city, small factory town, and rural environments.

The outside criteria.—In order to have this variety, the results of two examining bodies at the scholarship standard were taken, but one examining body covered all the children of the older group.

The procedure.—So that the chance conditions influencing performance in the tests would be as similar as possible to those operating during the examination, the testing was done as near as possible in point of time to the actual examinations. It was realised that the time of these children was very precious, and the testing time had been reduced as far as was compatible with efficiency in the preliminary work. Finally, permission was obtained to test the younger group in the week before they took their scholarship examination, and the older one immediately after the School Certificate examination.

(i) *The Junior Group.*

District A.—One hundred and twenty of the children described in the above section took the scholarship examination in this district.

Two parallel sets of papers were used by this authority, one for children whose ages fell between 10 years 11 months and 11 years 11 months, and another slightly easier set for those between 9 years 11 months and 10 years 11 months at the time of testing.

The results in the English and Arithmetic examination were available for all of the 120 children tested, but the results of the Intelligence Test were only obtained for twenty-one candidates in the Senior and for forty-one in the Junior Sections.

The analysis of the results of the 10y. 11m. to 11y. 11m. Section.

The correlations between all the nineteen tests given and the three papers in the scholarship examination were worked out by the Rank method if the numbers involved were few (e.g., in the Scholarship Intelligence Paper), and by the Product Moment method in the other cases. These correlations were then subjected to an analysis by the Thurstone method. The rotation for the *g* factor was, in the light of the preliminary work, made through the test of Verbal Analogies, and the *g* loadings of the papers in the examination were found to be :

	<i>g</i>	<i>n</i>	<i>v</i>
Arithmetic	·541	·409	·076
English	·466	·227	·535
Intelligence Test.....	·803	— ·143	·575

From these loadings it can be seen that the relative importance of the three factors was in the order of *g*, *v*, and *n*. Success in the Intelligence Test, which was verbal, depended almost entirely upon *g* and *v* in the ratio of about 8 to 6. In this group of children no allowance for differences in teaching was possible, for although one school provided a considerable number, most of the children had been selected from several different classes and from different schools, and the numbers from each school were too small to be considered separately. As a result of this, a small factor arising from differences in teaching and attitude to work seems to have arisen—thus the teacher who excels in making her children do well in Arithmetic seems likely to make them do so in English also. This additional loading would naturally fall into the first factor involving teaching taken in the analysis, after the *g* factor, which is presumably independent of teaching, had been removed. Accordingly the first factor taken after *g*, namely *n*, is a composite factor including this special number ability and the factor due to differences in teaching.

Success then in the English Paper seems to depend primarily upon the *v* factor (loading ·535) and the *g* factor (loading ·466), and to a smaller extent upon the factor probably arising from differences in teaching (loading ·227).

In the Arithmetic Paper, in which it must be remembered are both mechanical and problem sums, success depends upon *g* (·541), *n* and the teaching factor (·409), and *v* (·076).

Summing up very tentatively in view of the small numbers involved, it would seem that the three most important factors making for success at this stage are *g*, *n*, plus a teaching factor, and *v*. They are roughly in the ratio of 3 : 1 : 2 respectively.

The analysis of the results of the 9y. 11m. to 10y. 11m. Section.

The results for the younger and larger section were obtained by exactly the same method. The loadings for the parallel, although not identical papers, are given on the following page :

	<i>g</i>	<i>n</i>	<i>v</i>
Arithmetic	·434	·550	—·007
English	·116	·481	·505
Intelligence Test.....	·391	·320	·437

The difficulty noted in the Senior Section arising from the composite character of the second factor obtained, termed *n*, is found here in an intensified form. The difference in attainment and attitude to work assumes considerable importance in this table.¹ Since these younger children have had but five years in school, their standard of attainment in the 'tool' subjects of English and Arithmetic spreads its influence into the admittedly entirely *verbal* Intelligence Paper in the examination and into Mechanical Arithmetic. With this important aspect of the table in mind we may consider the influence of the general and special abilities upon success, as for the other group.

Success in the Intelligence Paper again depends upon the verbal factor to a considerable extent (·437) while the *g* factor is of about half the importance found for the older children, being (·391.) This difference may be accounted for in part by the fact that the Intelligence Paper was different and by the intrusion of the factor arising from differences in school attainment. Success in the Arithmetic Paper similarly depends upon *g* (·434), but to an even greater extent upon the factor termed *n*, which involves 'number' and differences in school teaching and attitude. In the English Paper the verbal factor is again of first importance, closely followed by the school factor, for seemingly the success of these younger people is dependent to a considerable extent upon the teaching they receive, and the *g* factor is of small importance in this paper.

It would seem, then, that the analysis for the younger group is much less complete than for the older group, the factors affecting success seeming to be more complex. Summing up, it may be suggested that the three most important factors are again *g*, *n* plus a teaching factor, and *v*. They are roughly in the ratio 1 : 1·5 : 1.

District B.—In this district three hundred children were tested. They were drawn from sixteen city schools and were between ten and twelve

¹ Evidence of very different standards of teaching in the junior schools was obtained, for although the average scores of the children from different schools were quite similar in the tests which were independent of teaching, the average scores differed to the extent of 10 per cent in Arithmetic and 12 per cent in English in the examination results.

years of age. These children had been selected by an internal examination by the heads of their respective schools for the scholarship examination.

The intercorrelations of the papers given by this authority were analysed as in District A, and the following factor loadings resulted :

	<i>g</i>	<i>n</i>	<i>v</i>	<i>Time allowed.</i>
Mental Arithmetic.....	·69	·03	·02	10 mins.
Mechanical „	·61	·10	·45	15 „
Problem „	·72	·13	·07	45 „
English Composition.....	·48	—·40	·49	30 „
„ Comprehension	·69	—·31	·11	45 „
Intelligence Test	·82	—·47	·20	60 „

The results of each of the above papers were available separately,^f and since the number of children was large, this group proved to be of great value from the point of view of this research. The factoria interpretation of success could be made with greater confidence than from the results obtained in District A.

That success in this Intelligence Test depended almost entirely upon the *g* factor is abundantly evident, but the *v* factor, although relatively small, is still playing its part. In this analysis the *v* factor was obtained by rotation through English Composition, and the resultant factor seems to have a composite character involving not only the verbal factor, but also a factor which was discussed in dealing with District A, and termed a 'school' factor. Success in Mental Arithmetic seems to depend to a great extent upon *g*, while the *n* and *v*, and probably 'school' factor, play relatively unimportant parts. The abilities operating in Mechanical Arithmetic present a somewhat different balance, for although *g* is still dominant, the 'school' factor and the 'number' factor are both playing a more important role. Proceeding to the Problem Paper, the influence of *g*, as was to be expected, assumes the dominant position while the 'number' factor is second in importance, and that of 'school' is present, but admittedly small.

In English the results are more instructive than those for District A, in that here the results for Composition and Comprehension are considered separately. In Composition the *g* loading is comparatively low, the verbal and 'school' factor together being first in importance. In the Comprehension Paper *g* is again dominant with a loading of ·688, while

the combined verbal and 'school' factor are present, but of relatively little importance.

Summarising for the analysis of the results for this district, it might be claimed (from the Σ of h^2) that about 60 per cent of the causes of success lie in the factors obtained, the analysis being most complete for the Intelligence Paper. Success again depends primarily upon the factors g , v , n , and a 'school' factor, but in this case, because of the length and high g loading of the Intelligence Test and the importance given to Comprehension in the English Paper, and to the Problem Section in Arithmetic, the relative importance of the factors differs from that in District A, the ratio of the factors g , n , and v being 15 : 1 : 5.

From this part of the research one very obvious and important conclusion must be stressed—namely, that the relative importance of general and special abilities upon success in the Scholarship Examination varies enormously with the make-up of the papers set, and further, even between papers which purport to cover the same ground; thus a paper termed English may be principally testing a verbal ability, and secondly a 'school' factor if the compositional aspect holds a dominant position, while the g factor may be of little importance. In another examination the English Paper may stress Comprehension rather than Composition, and the g factor becomes more important than the verbal in such a case. The greater the preponderance of the problematic type of sum in Arithmetic, the greater will be the relative importance of g , while the mechanical aspect of the subject will tend to involve the n and 'school' factor to a greater relative extent. Even in the Intelligence Tests great variation in the g loading will be found, the danger seeming to come from the tendency to involve a high loading of the verbal factor in some of the types of tests used. The verbal factor loadings of some such types of verbal tests were obtained in this research. Thus an 'Opposites' Test had a v loading as high as .587, Verbal Classification of .200, and Logical Selection of .270, and such are frequently included in an Intelligence Test.

As has been shown, success at the beginning of the secondary school career, in the districts studied, depended in the main upon the general factor and two special factors, namely v and n . Other special factors which may play an important part in affecting the extent to which a child will benefit from such education are ignored.

In the factor analysis of the tests used in the preliminary work, as described in the first part of this paper, the presence of a 'spatial' and 'spatial imagery' factor had been detected. The spatial factor had been greatest in the Paper Formboard Test, and the spatial imagery factor

greatest in the Paper Folding Test, and these tests had been used respectively as axes for the respective factors. The spatial tests, with the exception of the individual Passalong Test, had been given to the children whose scholarship papers had been analysed in both Districts A and B, and the results obtained were analysed by the same method as was applied to the scholarship papers. The Verbal Analogies Test, having already been found to be highly loaded with g , was used as the g axis. The Paper Formboard and Paper Folding Tests were used as axes for the spatial and spatial imagery factors respectively, following the findings of the preliminary work. The resultant factor loadings are given below :

	g	S_1	S_2
Analogies Test	·718	—	—
Paper Formboard Test	·234	·720	—
Paper Folding Test	·438	·530	·225
Correlate Education Test	·404	·244	—·308
Field Test	·407	·399	—·088
Spatial Symbols Test	·405	·040	—·344
Tracing Test	—·016	·383	—·232

From the above table it seems that there is a factor S_1 operating in all the spatial tests used. It therefore seems probable that this a spatial factor. The third factor, S_2 , is operating in the Paper Folding Test, and it is suggested, as in the preliminary work, that this may be a factor involving spatial imagery.

Finally, it may be concluded from the results of this part of the investigation that success at the beginning of a secondary school career depends upon g , v , and n , and a 'school' factor, while other factors such as S_1 , which were present in the tests (cf. the last table), hardly function in the Arithmetic, English, and Intelligence Papers of the authorities which were considered in this investigation.

Part II of this article will appear in the next issue.

PERFORMANCES IN THE CONSTITUENT PARTS OF A HIGHER SCHOOL CERTIFICATE EXAMINATION IN CLASSICS.

By JAMES A. PETCH.

- I.—*Introduction : the nature of the data.*
- II.—*Performances in the three subjects, Greek, Latin, and Greek and Roman History.*
- III.—*Performances in the parts of the subjects.*
- IV.—*Performances in the subjects and parts thereof at successive attempts.*
- V.—*Summary.*

I.—INTRODUCTION.

1.—The three subjects Greek, Latin and Ancient History form perhaps the most closely knit of all the subject groups which go to make up the curricula of schools. To what degree is ability in one of these subjects found to go with ability in one or both of the others so far as concerns school pupils?

2.—A public examination gives a wider field of enquiry than does a single school, a field too in which the influence of local or individual peculiarities is reduced. The results for three successive years in Group I (Classics) of the Higher School Certificate Examination of the Northern Universities' Joint Matriculation Board¹ have therefore been analyzed with a view to seeking some more or less quantitative answer to the following questions :

- (1) How far does ability in one classical subject go with ability in another classical subject?
- (2) How far does ability in one portion of a classical subject go with ability in another portion of that same subject or in a portion of another classical subject?
- (3) How far does ability in the subjects as a whole and in separate portions thereof remain constant from one examination to the examination of a subsequent year?

¹ I am indebted to the Board for permission to publish this paper, which is based upon material in its possession, and to Professor C. W. Valentine for valuable suggestions regarding the presentation of it.

Before an answer to these questions can be sought, however, it is necessary first to note certain limitations which condition the enquiry.

3.—Firstly the "ability" in question is ability as shown in an examination by answers to certain papers set on a specific occasion. The extent to which such "one-occasional" ability may coincide with ability shown over a longer or shorter period of preparation is outside the scope of this paper (but see para. 5 (*e*) below).

4.—Secondly the ability is measured not against any absolute standard, if such there be, but in terms of the order of merit in which the candidates were placed by the examiners; "rank correlations"² are employed throughout.

5.—Thirdly the efficiency of the examination which has produced the results must be considered to see how far consistency of verdict may be expected, how far variations are to be more properly ascribed to examiners than to candidates. In the absence of any absolute standard it is impossible to give a final answer. The following points do, however, help towards an informed opinion.

(a) In the three years reviewed all candidates in Group I offered the same three subjects, namely (i) Greek, (ii) Latin, (iii) Greek and Roman History. In Greek and in Latin there was a choice allowed to candidates only in so far as every candidate had to offer one of two prescribed prose texts and one of two prescribed verse texts, and there was a choice of question in Paper III in both Greek and Latin (General and Literary Questions). There was no choice of period in Greek and Roman History, but there was a choice of question.

(b) The syllabuses in the subjects were not changed during the period under review apart from (i) change of texts prescribed for Greek and for Latin, (ii) rotation of periods prescribed for Greek and Roman History. The first of the three successive years was, however, the first year in which these particular syllabuses and this particular arrangement of papers were in force; even so, the syllabuses then introduced were modified, not completely new, syllabuses.

(c) Throughout the three-year period there were no changes in the allocation of marks as between the various papers and sections of papers (Table I). Moreover it is the constant aim of the examining body to ensure that the papers set in one subject in one year approximate as closely as possible in standard to those set in other subjects in the same year and in the same subject in the previous year.

² Only the greatest "probable error" is given for each table or for each group of coefficients where N is constant or nearly so.

TABLE I.

PAPERS, MARKS AND EXAMINERS.

Section and Marks Allotted.		Examiner responsible.		
		1st year.	2nd year.	3rd year.
GREEK	Paper I (Prose : 28% marks) ..	A	C	C
	(Grammar : 7%) ..	A	C	C
	Paper II (Unseen Translation : 35%)	B	A	D
	Paper III (Prescribed Texts : 16%)	B	A	D
	(General Questions : 14%)	B	A	D
LATIN	Paper I (Prose : 28%) ..	E	E	H
	(Grammar : 7%) ..	E	E	H
	Paper II (Unseen Translation : 35%)	F	F	F
	Paper III (Prescribed Texts : 16%)	G	H	H
	(General Questions : 14%)	G	H	E
GREEK & ROMAN HISTORY	Paper I (Greek History : 50%) ..	J	K	L
	Paper II (Roman History : 50%) ..	K	L	K

(d) The arrangement of the papers in each subject and the distribution of the work of marking the scripts is shown in Table I. There was, therefore, a considerable degree of continuity in the membership of the examining panels and in the apportionment of work. Further there is no question of any variability in standard as between examiner and examiner in any one year; each year all answers to any particular portion of a paper were marked by one examiner. The allocation of individual portions did vary somewhat from year to year but in no year did one examiner mark, say, some of the Latin Proses and another examiner the remainder.

(e) The general "reliability" of any examination is always a matter for discussion. A comparison of the estimates submitted by the schools before the examination with the verdicts passed by the examiners does, however, assist towards a valuation of this factor, with the proviso that the school estimates are based upon the work of the candidates over the whole period of preparation, *i.e.*, at least two years normally, while the examiners' verdicts are, as stated in para. 3, primarily verdicts upon ability shown on a specific occasion and presumably under limiting conditions. The groups of classical candidates entered for this examination by individual schools are generally small and the varying methods and standards employed in arriving at and stating the estimates prevent a comparison with the examination results *en bloc*. In the

smaller groups of three and four candidates perfect agreement as to order of merit as between estimates and results was by no means uncommon. Weighted mean coefficients of correlation between school estimates and examination results for the three subjects for the larger groups (nine to nineteen candidates) over the three years were : Greek 0.87, Latin 0.85, Greek and Roman History 0.61 (P.E. ± 0.06). In Latin and Greek, therefore, the examination results agreed very well with the school estimates of the order of merit for the various groups ; in Greek and Roman History they agreed no less than they do for other subjects of the " essay " type.

TABLE II.

CORRELATION BETWEEN PERFORMANCES IN CLASSICAL SUBJECTS.

	<i>Number of Candidates.</i>	<i>Greek - Latin.</i>	<i>Greek- Greek and Roman History.</i>	<i>Latin- Greek and Roman History.</i>
1st year	189	0.90	0.65	0.65
2nd year	158	0.87	0.57 ¹	0.58
3rd year	151	0.91	0.60	0.64

¹ (± 0.04).

II.—HOW FAR DOES ABILITY IN ONE CLASSICAL SUBJECT GO WITH ABILITY IN ANOTHER CLASSICAL SUBJECT ?

6.—Table II gives the coefficients of rank correlation for the three years reviewed when the order of merit in one subject is compared with the order in each of the other two subjects of the group. Some basis of comparison is required. The most popular entry in " modern " subjects is for English, French, and History, in " science " subjects for Pure Mathematics, Applied Mathematics, and Physics. The correlations for a random group of 162 candidates offering these three modern subjects in one year were : English-French 0.49, English-History 0.55, French-History 0.48 (± 0.04). For a random group of 167 offering these three science subjects the coefficients were : Pure Mathematics-Physics 0.69, Pure Mathematics-Chemistry 0.61, Physics-Chemistry 0.67 (± 0.03).

7.—The combination French, German, and History, as it comprises two languages and an " essay " subject, may be considered to provide

a group of Arts subjects better for comparative purposes. The coefficients for the sixty-one candidates offering this group in one year were: French-German 0·82, French-History 0·49, German-History 0·44 ($\pm 0\cdot07$).

8.—If other subjects offered are ignored, 130 candidates offered French and German in one year; the coefficient of rank correlation was 0·78 ($\pm 0\cdot02$). Thirty-four candidates offered French and Spanish; the coefficient was 0·72 ($\pm 0\cdot06$).

9.—Thus there is a high correlation between results in Greek and results in Latin, appreciably higher than the correlation between results in any two modern languages. Correlation between results in Greek and Roman History on the one hand and results in the classical languages on the other is not so high. Linguistic ability in Classics is not markedly linked with ability in Ancient History.

III.—HOW FAR DOES ABILITY IN ONE PORTION OF A CLASSICAL SUBJECT GO WITH ABILITY IN ANOTHER PORTION OF THAT SAME SUBJECT OR IN A PORTION OF ANOTHER CLASSICAL SUBJECT?

10.—To what extent does the high correlation between Greek and Latin results hold good? Is it confined to the results in the two subjects as wholes, these results representing a balancing up of series of unequal achievements? Or is a candidate who offers up a good Greek Prose likely to offer up also a good Greek Unseen, a good Latin Prose and so forth?

11.—It is not possible within the limits of this paper to give separately for the three years the individual tables of the coefficients of correlation between the five portions into which each of the two language subjects falls (Table I). In Table III, therefore, are given the weighted means as follows:

(a) in columns 1 to 10 the mean coefficients of correlation between the portion specified on the left and the portions specified at the head of each of these columns;

(b) in column 11 the mean correlation of the portion specified on the left with the nine other portions in columns 1 to 10;

(c) in column 12 the Standard Deviation.

12.—As regards the details of which Table III is a summary:

(a) each year Greek Unseen gives the highest mean correlation with the other four portions of Greek, Greek General Questions the lowest; after Greek Unseen ranks Greek Prescribed Texts, third comes Greek Prose with Greek Grammar close behind;

TABLE III.
CORRELATION BETWEEN PERFORMANCES IN THE SPECIFIED PORTIONS (WEIGHTED MEANS FOR THREE YEARS).

	1	2	3	4	5	6	7	8	9	10	11	12
GREEK	GREEK.											
	Prose.			Unseen. P. Texts.			Prose.			LATIN.		
	Gram.			Gen. Q.			Gram.			Unseen. P. Texts.		
	Gen. Q.			Gen. Q.			Gen. Q.			Gen. Q.		
	Prose ..	0.51	0.71	0.53	0.46	0.68	0.51	0.70	0.48	0.40	0.55	0.11
	Grammar ..	0.51	0.59	0.56	0.50	0.49	0.54	0.56	0.52	0.45	0.53	0.04
	Unseen ..	0.71	—	0.70	0.55	0.67	0.60	0.89	0.62	0.43	0.64	0.12
	P. Texts ..	0.53	0.70	—	0.57	0.50	0.58	0.68	0.76	0.43	0.59	0.10
	Gen. Ques...	0.45	0.50	0.55	—	0.41	0.43	0.53	0.53	0.65	0.51	0.07
LATIN	LATIN.											
	Prose ..	0.68	0.49	0.67	0.50	—	0.54	0.71	0.48	0.37	0.54	0.12
	Grammar ..	0.51	0.54	0.60	0.58	0.54	—	0.60	0.53	0.38	0.52	0.08
	Unseen ..	0.70	0.56	0.89	0.68	0.71	0.60	—	0.62	0.44	0.64	0.12
	P. Texts ..	0.48	0.52	0.62	0.76	0.48	0.53	0.62	—	0.43	0.55	0.09
	Gen. Ques...	0.40	0.45	0.43	0.43	0.37	0.38	0.44	0.43	—	0.44	0.08

 ± 0.03

(b) Latin Unseen always has the highest mean correlation with the other four portions of Latin, Latin General Questions the lowest, but the relative positions of the remaining three Latin portions are not constant ;

(c) in each year Greek Unseen gives the highest mean correlation with the five Latin portions while Greek Prescribed Texts rank second, Greek Prose third, the remaining two Greek portions showing little differentiation ;

(d) of the Latin portions Latin Unseen gives the highest mean correlation with the Greek portions ; the order of the means for the remaining four Latin portions fluctuates from year to year, save that Latin General Questions always occupies the fifth place ;

(e) when the mean correlation of each portion with the remaining nine portions, Greek and Latin, is considered, either Greek Unseen or Latin Unseen gives the highest mean each year ; each year Greek Prescribed Texts comes third, while Latin Prescribed Texts is fifth, fifth, and sixth ; Greek Prose (fourth, fourth, eighth) fluctuates with Latin Prose (ninth, seventh, fourth) ; each year Latin General Questions is tenth.

TABLE IV.

CORRELATION BETWEEN PERFORMANCES IN PORTIONS : COEFFICIENTS AND WEIGHTED MEANS (ALL THREE YEARS) OF AT LEAST 0.70.

	1st year.	2nd year.	3rd year.	Weighted mean (all three years).
Greek Prose-Greek Unseen	0.76	—	0.73	0.71
Greek Prose-Latin Prose	—	—	0.73	—
Greek Prose-Latin Unseen	—	—	0.73	0.70
Greek Unseen-Greek P. Texts	0.70	—	0.72	0.70
Greek Unseen-Latin Prose	—	—	0.77	—
Greek Unseen-Latin Unseen	0.88	0.88	0.91	0.89
Greek P. Texts-Latin Unseen	—	—	0.70 ¹	—
Greek P. Texts-Latin P. Texts	0.79	—	0.82	0.76
Greek Gen. Ques.-Latin Gen. Ques. ..	0.71	—	—	—
Latin Prose-Latin Grammar	—	—	0.72	—
Latin Prose-Latin Unseen	—	—	0.80	0.71

¹ (± 0.03).

13.—In Table IV are given all instances in which the coefficient of correlation for two portions was at least 0.70. Only one pair appears in all three years—Greek Unseen and Latin Unseen. As, moreover, the

three coefficients for this pair are never less than 0.88, it would appear that in the examination a good (or bad) performance in Greek Unseen is generally accompanied by a good (or bad) performance in Latin Unseen.

14.—Three pairs appear in two years; in each case in the missing year the coefficient was well over 0.60. It would appear, therefore, that there is a significant degree of correlation between the following pairs:

(2) Greek Prescribed Texts and Latin Prescribed Texts;

(3) Greek Prose and Greek Unseen;

(4) Greek Unseen and Greek Prescribed Texts.

To this list may be added the two pairs (5) Latin Prose and Latin Unseen, (6) Greek Prose and Latin Unseen; in each case the means are greater than 0.70 and the terms missing from Table IV approximate closely to the limit adopted.

15.—Negatively: (a) in no year was the correlation between Greek Prose and Latin Prose one of the five highest, the mean being 0.68;

(b) in every year the lowest correlations were those in which either Greek General Questions or Latin General Questions was concerned;

(c) almost uniformly low correlations were given by (i) Latin Grammar and Latin General Questions, (ii) Latin Prose and Latin General Questions.

16.—Before conclusions are drawn from these observations any variables should first be considered. The effect of some possible variables is imponderable—for instance, the standard of the papers (*cf.* para. 5 (c)); one variable of which the influence can at least be estimated is the examiner marking the scripts (Table I). In Table V, therefore, are set out the pairs of portions between which correlation is high or low, together with the examiners responsible for the marking.

TABLE V.

HIGH AND LOW COEFFICIENTS FOR PERFORMANCES IN PORTIONS WITH EXAMINERS RESPONSIBLE FOR MARKING.

	1st year.		2nd year.		3rd year.	
	Coef.	Exmrs.	Coef.	Exmrs.	Coef.	Exmrs.
(a) Greek Unseen-Latin Unseen ..	0.88	B, F	0.88	A, F	0.91	D, F
(b) Greek P. Texts-Latin P. Texts	0.79	B, G	0.66	A, H	0.82	D, H
(c) Greek Prose-Greek Unseen ..	0.76	A, B	0.64	C, A	0.73	C, D
(d) Greek Unseen-Greek P. Texts	0.70	B, B	0.69	A, A	0.72	D, D
(e) Greek Prose-Latin Unseen ..	0.69	A, F	0.69	C, F	0.73	C, F
(f) Latin Prose-Latin Unseen ..	0.66	E, F	0.68	E, F	0.80	H, F
(g) Greek Prose-Greek Gen. Ques.	0.49	A, B	0.47	C, A	0.37	C, D
(h) Latin Grammar-Latin Gen. Ques.	0.42	E, G	0.33 ¹	E, H	0.39	H, E
(j) Latin Prose-Latin Gen. Ques.	0.33	E, G	0.35	E, H	0.43	H, E

¹ (± 0.05).

17.—Table V, line (a). The high correlation between Greek Unseen and Latin Unseen cannot be entirely ascribed to continuity of examiners. The examiner marking Latin Unseen was unchanged, but three different examiners marked the Greek Unseens. In view of this and the facts contained in para. 13, it may be concluded that there is something in the nature of a "facility for Unseens" which is shown by the same candidate both in Greek and in Latin.

18.—Table V, lines (b), (c), (d). In each of these three lines the second year shows the lowest coefficient and in each line examiner "A" appears in the second year. His marking may, therefore, be taken as influencing the degree of correlation but the extent of his influence seems to vary: in line (b) it appears to be considerable, in line (d) his correlation with himself, as it were, is practically identical with the correlation in the first year, "B" marking both portions, and only slightly less than that in the third year, "D" marking both portions. It may, therefore, be concluded that there is a significant degree of correlation between abilities in these respective portions though in three specific instances the correlation varied in greater or less degree with the examiners who marked the scripts.

19.—Table V, lines (e) and (f). Line (e) calls for little comment: there is little variation from year to year in the coefficients and examiner "F" marked the Latin Unseens each year, his results in the first year corresponding well with those of "A" for Greek Prose, in the other two years with those of "C." Line (f) on the other hand suggests that the high correlation in the third year may be at least partly due to the substitution of "H" for "E." The pair "E, F" are consistent at an appreciably lower level, and the somewhat paradoxical conclusion appears to be that examination results in Latin Unseen correspond as closely to results in Greek Prose as they do to results in Latin Prose (*cf.* Table III).

20.—Table V, lines (g), (h) and (j). Three different examiners marked Greek General Questions, three different examiners marked Latin General Questions; the coefficients are always low. The lowness may, therefore, be attributed to the nature of the work rather than to the standards of the examiners.

21.—As regards the third subject of Group I, Greek and Roman History, when the performances of candidates in Paper I (Greek History) are correlated with their performances in Paper II (Roman History), the resulting coefficients are for the first year 0.58, for the second 0.66, for the third 0.59 (± 0.04); the correlation between the results in the two papers is, therefore, of much the same degree as that between the results in the subject as a whole and the school estimates (para. 5 (e)).

22.—The answer to the question at the head of this section is, therefore, as follows:

(a) A candidate who performs well in Greek Unseen generally does well in Latin Unseen and *vice versa*. If this is due to some "Unseen facility," there is little evidence of any corresponding "Prose facility."¹

(b) The performance of a candidate in Unseens (Greek and Latin) corresponds most closely to his performances in other portions of the subjects, more closely than do his performances in Prose (Greek and Latin). After the Unseens in degree of correspondence come Greek Prescribed Texts. A performance in Greek General Questions or in Latin General Questions bears little relation to what the candidate does in other portions.

(c) The high correlations between the subjects Greek and Latin as a whole (Table II) are not accompanied by equally high correlations between portions of the subjects, Unseen Translation excepted. Generally, therefore, a candidate's performance in Greek or Latin as a whole is the sum of unequal performances in the portions of the subject.

23.—To conclude this section some statistics from a School Certificate Examination of the same Board are given for comparison.

(a) Three hundred and forty-seven candidates offered both Greek and Latin; the coefficient of rank correlation was 0.78 (± 0.01); cf. Table II.

(b) The correlation between performances in Latin, Paper I (Grammar, Unseen, Composition) and in Latin, Paper II (Prescribed Texts) of a random 714 candidates was 0.74 (± 0.01); cf. Table III. For Greek I (Grammar, Unseen, Sentences) and Greek II (Prescribed Texts) the correlation was also 0.74 (± 0.02). In comparing these School Certificate figures with those for the Higher School Certificate the greater sectionalization of the Higher School Certificate results must be borne in mind.

IV.—HOW FAR DOES ABILITY IN THE SUBJECT AS A WHOLE AND IN SEPARATE PORTIONS THEREOF REMAIN CONSTANT FROM ONE EXAMINATION TO THE EXAMINATION OF A SUBSEQUENT YEAR?

24.—Approximately one quarter of all the candidates for the N.U.J.M.B. Higher School Certificate in any one year are making their second attempt at the examination. For Group I the proportion is

¹It might be suggested that, since the passages set for Unseen Translation are two to three times as long as the passages set for Prose, a candidate may have a better opportunity of doing himself justice in the Unseen Translation paper. As against this, however, it is undoubtedly much harder to ensure that a passage for Unseen Translation shall be really "unseen" for all candidates than to set a passage for Prose from an unknown source.

higher : (i) of the 158 candidates offering Group I in the second year under review, 60 had offered the group in the previous year ; (ii) of the 151 offering the group in the third year, 62 had offered it in the second. In considering the successive performances of these candidates the statements in para. 5 are of especial relevance.

25.—In Table VI are given (a) the correlations between the performances in a subject in the first year and performances by the same sixty candidates in the same subject in the second year, (b) correlations for sixty-two attempts in the second and third years.

TABLE VI.
CORRELATIONS BETWEEN PERFORMANCES IN SUCCESSIVE YEARS
(WHOLE SUBJECTS) : PARA. 25.

Greek : (a) 1st year-2nd year	0.78
(b) 2nd year-3rd year	0.83
Latin : (a) 1st year-2nd year	0.83
(b) 2nd year-3rd year	0.79
Greek and Roman History : (a) 1st year-2nd year		0.69
(b) 2nd year-3rd year		0.47 ¹

¹ (± 0.07).

26.—Both for Greek and for Latin there is a very fair degree of correlation between performances in successive years though the coefficients are not so high as those of Table II. A factor of unascertained significance may contribute towards this—the amount of time which elapses between a candidate beginning Latin and his beginning Greek, variable from school to school. Unless the two languages are begun together, an unusual occurrence in N.U.J.M.B. schools, at his second attempt the difference between the time the candidate has spent on Latin and the time spent on Greek will, of course, be proportionately less than it was at his first attempt.

27.—As regards Greek and Roman History, Table VI shows a degree of correlation for the first year-second year attempts which is not borne out by the second year-third year attempts, although examiner "J" examined only in the first year together with "K," while in both the second and third years examiners "K" and "L" worked together. It seems safer, therefore, not to stress unduly the higher coefficient.

28.—There remains the second part of the problem with which this section deals—How do candidates fare in successive attempts at

the same portions of the subjects? How do performances in, say, Latin Unseen of one year compare with performances by the same candidates in Latin Unseen of the next year? Table VII gives the correlations for such performances under (a) for the sixty candidates under para. 25 (a), under (b) for the sixty-two candidates under para. 25 (b). After each coefficient are given the examiners concerned.

TABLE VII.

CORRELATION BETWEEN PERFORMANCES IN SUCCESSIVE YEARS (PORTIONS OF SUBJECTS) AND EXAMINERS RESPONSIBLE FOR MARKING: PARA. 28.

	GREEK.				LATIN.			
	(a) 1st year- 2nd year.		(b) 2nd year- 3rd year.		(a) 1st year- 2nd year.		(b) 2nd year- 3rd year.	
	Coef.	Exmrs.	Coef.	Exmrs.	Coef.	Exmrs.	Coef.	Exmrs.
Prose	0.48	A, C	0.67	C, C	0.60	E, E	0.58	E, H
Grammar	0.54	A, C	0.40	C, C	0.42	E, E	0.41	E, H
Unseen	0.85	B, A	0.81	A, D	0.82	F, F	0.84	F, F
Prescribed Texts ..	0.50	B, A	0.59	A, D	0.40	G, H	0.48	H, H
General Questions	0.39	B, A	0.57	A, D	0.52	G, H	0.37	H, E

	GREEK AND ROMAN HISTORY.			
	(a) 1st year- 2nd year.		(b) 2nd year- 3rd year.	
	Coef.	Exmrs.	Coef.	Exmrs.
Paper I	0.57	J, K	0.42	K, L
Paper II	0.52	K, L	0.28 ¹	L, K

¹ (± 0.08).

29.—In para. 17 it was suggested that there was something in the nature of a facility for Unseens holding good both in Greek and in Latin. Further evidence for this is given by Table VII, which suggests that not only is a candidate who is good (or bad) at Latin Unseen generally good (or bad) at Greek Unseen, but that a candidate continues to achieve approximately the same goodness (or badness) from year to year. The uniformly high coefficients in this table for successive attempts at Greek Unseen and at Latin Unseen cannot certainly be ascribed only to the

examiners themselves. "B" marked Greek Unseens the first year, "A" the second; their verdicts upon sixty candidates in successive years produce the high coefficient of 0.85. "F" marked Latin Unseens in all the three years and the two coefficients resulting are 0.82 and 0.84. This Unseen facility is, therefore, constant within narrow limits.

30.—As in para. 22 (*a*), so here it may be said that there is no evidence of a corresponding Prose facility. Examiner "C" produces, under (*b*), a much higher correlation between his successive verdicts upon Greek Proses than do examiners "A" and "C," under (*a*); on the other hand in Latin Prose, under (*a*), examiner "E" agrees with himself in successive years only as well as he does with examiner "H," under (*b*).

31.—In the period reviewed seventeen candidates made three successive attempts at the group. The results of an analysis of their performances cannot be stressed; they do, however, bear out generally the conclusions of this section.

32.—The answer to the question at the head of this section is, therefore, that, while there is fair constancy in Greek and Latin performances as wholes, there is no marked constancy as regards the various portions except in Unseen, where the degree of constancy is considerable. In all other portions ability varies much from year to year.

V.—SUMMARY.

33.—Bearing in mind the limitations of the enquiry (paras. 3 and 4) and assuming that there is evidence that the demands of and evaluation by the examiners do not fluctuate greatly throughout the examination in one year or from year to year, the following conclusions emerge.

(*a*) Ability in Greek is closely linked with ability in Latin, whereas ability in the two languages bears no marked relation to ability in Greek and Roman History.

(*b*) Equally meritorious performances in Greek and Latin as whole subjects may be resolved into very unequal performances in the various portions of the subjects, except that ability in Greek Unseen is very closely linked with ability in Latin Unseen.

(*c*) Generally performances in Unseen Translation (Greek and Latin) correspond the most closely to performances in other portions of the subjects, while ability at Unseen Translation is the most stable (*i*) within the examination of a single year, (*ii*) from one year to the next, being much more stable than any ability for Prose.

(*d*) Ability in General and Literary Questions is consonant with very unequal performance in other portions of the language subjects.

34.—For a full discussion of ability in Classics in a wider and more general sense than that used in this paper (para. 3) many more factors

must, of course, be considered. It would, therefore, be unwise merely on the evidence which may have come to light from this enquiry to lay too much stress on what that evidence suggests, namely that in any examination in Classics in which Prose Composition were allowed to play the predominating part the examiners would be stressing an ability which is variable as contrasted with the much greater constancy of ability in Unseen Translation.

RÉSUMÉ.

DES RÉSULTATS DANS LES PARTIES CONSTITUANTES D'UN EXAMEN DU "HIGHER SCHOOL CERTIFICATE" DANS LES LANGUES ANCIENNES.

L'on analysa les résultats pendant trois ans dans les trois branches, le grec, le latin et l'histoire ancienne, et dans les sections de ces branches, dans l'examen du "Higher School Certificate du Northern Universities Joint Matriculation Board." Le coefficient de la corrélation le plus bas entre les résultats en grec et en latin était 0.87. Les résultats ne correspondaient pas de très près aux résultats dans l'histoire ancienne. Le coefficient de la corrélation le plus bas entre la version grecque et la version latine était 0.88; la corrélation entre les résultats dans les autres sections n'était pas si élevée. Environ deux cinquièmes du nombre des candidats se présentèrent à l'examen au moins deux fois. Le coefficient de corrélation le plus bas entre deux tentatives successives en version était 0.81; dans les autres sections des branches la coefficient n'était nulle part au-dessus de 0.67. Il semble y avoir quelque témoignage d'une aptitude spéciale à la version, qui est valable pour les deux langues, et qui reste stable d'année en année.

ZUSAMMENFASSUNG.

LEISTUNGEN IN DEN BESTANDTEILEN EINER PRÜFUNG IN KLASSISCHEN SPRACHEN UND ALTER GESCHICHTE IM HIGHER SCHOOL CERTIFICATE (ENGLISCHEN SCHULABGANGSZEUGNIS).

Man hat Leistungen in drei Fächern Griechisch, Latein, und alter Geschichte und in den drei Teilen dieser Gegenstände in der H.-S.-C.-Prüfung der N.U.J.M.B.-Behörde über einen Zeitraum von drei Jahren analysiert. Der niedrigste Korrelationskoeffizient zwischen Leistungen in Griechisch und Latein ergab sich als 0,87; Leistungen in diesen Sprachen standen nicht in sehr naher Verbindung mit Leistungen in alter Geschichte. Der niedrigste Korrelationskoeffizient zwischen Leistungen in nichtvorbereiteter Übersetzung aus dem Griechischen und nichtvorbereiteter Übersetzung aus dem Lateinischen war 0,88; die Korrelation zwischen Leistungen in anderen Teilen war nicht so hoch. Annähernd zwei Fünftel der in Frage kommenden Kandidaten machten mindestens zwei Versuche beim Examen. Der niedrigste Korrelationskoeffizient zwischen aufeinander folgenden Versuchen im nichtvorbereiteten Übersetzen war 0,81; für keinen anderen Teil der Fächer war der Koeffizient höher als 0,67. Es gibt anscheinend Beweise von besonderer Fähigkeit für nichtvorbereitete Übersetzung, die in anderen Sprachen vorhanden ist und von Jahr zu Jahr bleibt.

THE FACTORIAL ANALYSIS OF HUMAN ABILITY.

By GODFREY THOMSON, D.Sc., Ph.D., Professor of Education in the University of Edinburgh. (University of London Press, Ltd., 1939, pp. xvi+326. 16s.)

THE theory of factors made its first appearance as an offshoot of the mental testing movement ; but it has come to play much the same part in modern psychology as the theory of linear operators in modern physics. Indeed, as branches of mathematics both are closely akin. Prof. Thomson was one of the first to introduce standardized tests of intelligence and attainments into the regular examinations for junior county scholarships and the like ; and, in the endeavour to put such examinations on a more scientific basis, he was led at the very start to scrutinize the nature and the defects of the procedure from a mathematical standpoint.

What are the factors that chiefly influence an examinee's performance in such tests ? How can they be discovered, described, and assessed ? To answer such questions numerous methods of ' factor-analysis ' have from time to time been put forward ; and a further problem therefore arises : which out of all these methods is the best ? As Prof. Thomson observes, " before any practical use can be made of such analysis, a thoroughgoing examination of its mathematical foundations is necessary." Accordingly, he has himself undertaken a comprehensive review of the various basic principles proposed, and carefully compared the merits and the defects of each procedure.

The results of his work fully justify the eagerness with which they have been awaited. To the non-mathematical factor-analysis wears a formidable aspect. But Prof. Thomson's book can be understood by students with little or no mathematical knowledge beyond what is ordinarily imparted in a secondary school. At the same time even professional statisticians will welcome, not merely the succinct compendium of formulae and proofs brought together in the mathematical appendix, but also the new light thrown on old problems and on familiar solutions at almost every turn of the page. Throughout the author reveals himself, not only as a brilliant mathematician, but also as a brilliant teacher. The structure of the book, the compact and lucid style, the ingenious devices used to illustrate geometrical conceptions and arithmetical proofs, make the whole work easy to follow and brimful of interest.

The introductory explanations are simplified by assuming that sampling errors may be provisionally ignored. On this basis Part I deals with ' the analysis of the tests.' As his starting point, Prof. Thomson takes the simple hierarchy of test-correlations on which the two-factor

theory was founded. To the pioneer work of Prof. Spearman he pays a generous tribute. "The main idea which still, rightly or wrongly, dominates factorial analysis was enunciated by him, and practically all that has been done since has been either inspired or provoked by his writings." He then describes how, at a very early period, it became necessary to contemplate group factors for more specialized abilities, in addition to the single central factor popularly termed intelligence, and how the subsequent investigations of Maxwell Garnett and others led to the idea of a multiple-factor analysis as a natural extension of the initial two-factor procedure. The more elaborate methods of Thurstone, Hotelling, and Holzinger are then examined in a way that is at once clear and impartial.

Part II deals with the estimation of factors by regression and other methods. Here and elsewhere Prof. Thomson makes a fruitful use of some of the neat expedients devised by his colleague, Dr. Aitken, for solving what are essentially problems in matrix algebra. Once again the technical explanations are most skilfully treated. The essential principles are introduced as they are needed; and, before he reaches the mathematical appendix, the student will have realized how a novel branch of algebra, unexpectedly easy in its more elementary applications, simplifies and abridges both exposition and investigation.

Part III discusses the complications introduced by sampling and selection, and considers their effects on two-factor and multiple-factor analysis. In Part IV we reach a topic of special interest to the educationist—the proposal to correlate persons instead of tests. As Prof. Thomson points out, the device of correlating persons, with or without the additional idea of extracting factors and determining types, has long been in use; but it is only during the last two or three years that it has come to the front as a topic of controversy. He first reviews experiments in which the general factor for persons forms the chief centre of interest. Children are asked to rank pictures, literary extracts, school subjects and the like according to their preference; examiners are asked to rank essays or examination papers according to their intrinsic merit. How far are the judgments consistent, and what are the causes of the agreement and the disagreement? A number of experiments of this kind have been carried out at the London Day Training College, at University College, and elsewhere, and reported in this *Journal*. In view of their recent applications to so many practical problems in both educational and vocational psychology, Thomson's critical examination of such methods, and of the incidental difficulties to which they give rise, is a welcome contribution.

A chapter is devoted to the relation between test-factors and person-factors; and in his final chapter, headed 'stop press,' he returns to the issue again. The suggestion that, whether we start by correlating persons or by correlating tests and traits, the secondary factors and the corresponding types will nevertheless remain approximately the same, he accepts only with definite reservations; and he points out, with perfect justice, that any endeavour to generalize an equivalence obtained under special conditions and by special methods must raise a good many supplementary problems that have yet to be solved.

To the educationist, however, the most interesting section of all will be the last. Part V brings the volume to a close with a full discussion of 'the interpretation of factors.' Spearman's g and its identification with 'mental energy', Thurstone's 'simple structure' which abolishes g , are considered in turn; and a much-needed caution is registered against the common tendency to 'reify factors'. And then, in what (apart from 'stop press') is the concluding chapter, Thomson fills in the earlier sketch of his own 'sampling theory'.

The sampling theory is the most far-reaching of Prof. Thomson's many original contributions to the subject. Briefly, he holds that the effect of any mental test is best described by supposing that each "calls upon a sample of the numerous bonds which the mind can form", i.e., it excites a definite number, but a random selection, of the examinee's "neurone arcs". As every reader will remember, the hypothesis was first put forward as an alternative to Prof. Spearman's theory of two factors. The phenomenon which both are concerned to explain is the hierarchical arrangement that all the early correlation tables seemed to exhibit. According to Thomson this singular tendency is "the result, not of any psychological laws, but simply of the laws of chance."

The conclusions to which this standpoint commits us are of such importance both practically and theoretically that they require examination at some length. Their practical importance will be obvious to every educationist. A teacher examining his class in geometry or French cannot possibly ask his pupils to demonstrate all the propositions they are supposed to know or to translate all the words or sentences they are supposed to understand: he can only ask for specimen replies, and judge from those. Psychologists continually remind him that his class forms only a sample of the total school population, and probably a selected sample at that: but this kind of sampling does not trouble him. What concerns him is the fact that each pupil's answers yield only a sample of his total knowledge. A different test-paper might lead to very different revelations.

Thomson's problem, however, is not so much the sampling of the tests, or even of the contents of the mind, but rather the sampling of its capacities. The theoretical significance of his conclusions is therefore greater still. No one, I fancy, would now question his mathematical deduction. The criticisms most commonly urged are directed rather against the tacit assumptions: can we really accept the implicit principle that the essential working of the brain can be reduced to these simple algebraic formulae? Thomson's reply is briefly as follows. In psychology, as in every other science, we must take the smallest possible number of the simplest possible postulates that can be extracted from facts at present known to us, and see how far we can deduce from them the rest of the facts—including those that have never been suspected and have still to be verified by experiment.

Six postulates seem implied in Thomson's theory. Let me try to formulate them in Thomson's own terms—though perhaps he may protest that my summary gives his picture too definite and too concrete a colouring. So far as they go, I believe every psychologist—including Spearman himself—would accept them. (i) The human brain is a comparatively undifferentiated structure of cellular elements: these elements are so numerous and so similar that for statistical purposes their behaviour may, to a first approximation, be treated as that of a homogeneous population almost infinitely large. (ii) By means of association paths or 'bonds' each cell is connected, directly or indirectly, with every other: no doubt, the lower levels of the central nervous system are loosely organized into so-called 'centres'—forming 'sub-pools' within the total 'pool'; but on the higher levels localization is ill-defined; and, as compared with the members and organs of the body, "the mind shows hardly any structure". (iii) Owing to these interconnecting paths, the energy supplied to, or liberated within, the brain can in theory spread from any one part to any other, so that the total amount of nervous energy can be regarded as forming a single fund. (iv) The stimuli that make up any cognitive test in ordinary use are so numerous that they call into play a mass action of the brain as a whole rather than one or two localized areas. (v) Even so, however, we may distinguish different degrees of complexity both in brains and in tests. Tests differ widely in 'richness', i.e., in the number of 'neurone arcs' they tend to excite, and consequently in the extent to which they are likely to overlap. (vi) Similarly, persons differ widely in the 'richness' of their brains, i.e., in the number of neurone arcs they present to the tests; and, except in rare pathological cases, these differences are general rather than local, characteristic of the tissue as a whole rather than of different areas or layers.

If this is the apparatus, how does it function? How precisely does the initial disturbance, produced by the test-stimuli, distribute itself throughout the brain, before it discharges in muscular action? My own hypothesis—one which would seem largely to reconcile Thomson's views with Spearman's—would begin by laying down four further conditions. The choice of the outgoing path must be determined (i) by the initial arrangement of the various 'neurone arcs'; (ii) by the point at which the incoming currents enter the system; (iii) by the differential resistances met with at successive cell-junctions; and (iv) by the tendency of the currents themselves to establish some kind of equilibrium. Without some such further assumptions we cannot, so it seems to me, offer any clear account of the actual responses to our tests. The scheme is really McDougall's (though, I admit, he himself would be a little shocked at the use I have made of it); and the outcome can be expressed in his own familiar phrase—'an ever-changing tri-dimensional neuergic pattern'¹. If we add (v) a small factor of 'indeterminacy', we can satisfy all that the sampling theory and the hormic theory have, in my view, a right to claim.

And now, with the assumption of less than a dozen constants, we could deduce, as I have elsewhere ventured to suggest, a whole theoretical science of 'neurodynamics', seeking to explain all the measurable phenomena that enter into our tests—the speed of simple and compound reaction-times, the conditioning of reflexes, the eduction of relations and correlates, and even, with matrices to describe the patterns, the perception of Gestalten. A mathematical neurology of this kind may sound far-fetched: but twenty years ago it would have seemed equally far-fetched to explain the efficient or inefficient reception of an orchestral concert by the wiring plan of a receiving-set and a string of differential and integral equations. And the value of all such simplified systems lies, not merely in what they explain, but still more in what they fail to explain.

The hypotheses of Spearman and Thomson take short-cuts towards a simpler solution still. Spearman assumes that the distribution of nervous energy is analogous to the distribution of a limited supply of current from a central generator to various specific engines, "much as the electricity that comes to our houses is distributed to a light-bulb,

¹ "Physiological Factors of the Attention-Process," *Mind*, XII (1903), p. 301. McDougall's 'teleological principle of conation' is really covered by my condition (iv), which is identical with the interpretation of it given by Stout and Avenarius: 'the teleological aspect of conscious activity has its physiological counterpart in the tendency of neural systems to return towards a state of equilibrium' (cf. *Philosophie als Denken gemäss dem Prinzip des kleinsten Kraftmasses*, 1876, p. 45).

a heater, a cooking stove, a radio set and perhaps an electric razor." Thomson prefers to make no specific postulates about directing agencies whatever. All we know about the tests is that each excites a certain specifiable proportion of nerve-elements out of the grand total: which elements they excite, and the consequent patterns produced, must therefore be treated as the result of sheer chance. And so, *for a first approximation*, he assumes—as every statistician would in dealing with “a complex but unknown background of causes”—that the distribution of nerve stimulations obeys the laws of probability and nothing more—like the distribution of the streams of shot poured out in Galton's well-known binomial machine. The immediate inferences are obvious and illuminating: the overlapping of the tests explains their correlations: the saturation coefficients for the tests measure their ‘richness’ or complexity: the factor-measurements for the persons measure the ‘richness’ of the persons’ brains. And the statistical nature of mental testing may be exemplified by tossing dice, and adding up the scores.

From the two antagonistic assumptions made by Spearman and Thomson respectively there follow a series of opposed corollaries which, in spite of their theoretical origin, have an important bearing on educational practice. (i) According to Spearman's interpretation, an individual's g measures the limited amount of mental energy he has at his disposal; according to Thomson, it indicates the limited number of neurone arcs that his brain can call upon—a view that comes very near to Thorndike's ‘quantity hypothesis’ (“quality of intellect depends upon quantity of neural connections”¹). Individual differences in mental energy are not a cognitive but a conative phenomenon—they represent differences in strength of motive-power rather than in strength of intellect. (ii) With each of our tests the correlations are far from perfect, and with certain tests (e.g., tests of simple sensation or movement) the correlations are decidedly low. According to Spearman, this is because each test depends on a specific ability or ‘engine’ peculiar to itself—an ability which (in the case of the simpler processes) far outweighs the influence of the general energy. According to Thomson, an imperfect correlation merely means that not all the pool of neurones has been sampled: for if two tests are of narrow scope they have little chance to overlap. Thus, the two factor theory regards g as a part of the test; and the sampling theory considers the test as a part of g . The practical inferences are plain. If these specific abilities really exist, their measurement should obviously play an important part in educational and vocational guidance; but if not, our practice should be radically altered. (iii) Finally, there is a more

¹ E. L. THORNDIKE: *The Measurement of Intelligence* (1925), p. 415.

abstract corollary. Both Spearman and Thomson admit that the hierarchical tendency is never exact. Spearman attributes the inexactitude to the fact that only a random part of the total pool of *persons* has been sampled; Thomson attributes it to the fact that only a random part of the total pool of *neurones* has been sampled. This at once suggests two crucial experiments that might serve to decide between the two theories.

It will thus be seen that the sampling theory, as developed by Thomson, is primarily opposed to the popular analysis of the mind into a few independent 'unitary abilities', 'factors', or 'traits', in much the same way as the associationist doctrine, as developed by Thorndike, was opposed to the traditional analysis of the mind into a composite of a dozen or so 'faculties'; and so far as it goes, it has much the same arguments in its favour. The reader, however, may naturally ask whether the objections so often urged against Thorndike's associationist doctrine cannot also be urged against Thomson's sampling theory. Can we ever reduce what Stout would call 'noetic synthesis' and what Spearman would call the 'eduction of relations and correlates' to the blind play of mechanical associations? And is it not precisely in the testing of intelligence that the former supersede the latter? "We shall never be able," says Koffka, "to deduce organization or orderly arrangement from the mere indifferent 'spreading' or interpenetration of nerve-currents into innumerable isolated elements." By omitting all reference to the 'integrative action of the nervous system,' has not our physiological picture suppressed something which rules *random* sampling almost entirely out of the question?

One final objection may be raised, which to the educationist might at first seem the most serious of all. 'Dice,' as Prof. Thomson admits, 'cannot be educated.' Yet educability is one of the most striking symptoms of intelligence; and, as he himself points out, the diminution of the hierarchical tendency in correlations obtained from older children seems to mean that 'education imposes a structure on the mind which is absent in the young.' With what may be called the 'directed nerve-current' hypothesis, described above (as distinct from a simple 'nerve-excitation' hypothesis—for physiologically that is what sampling reduces to) it would be by no means difficult to construct a plausible neurodynamic explanation: as every wireless engineer discovers to his cost, certain parts of his electrical circuits display a residual as well as a permanent 'retentivity'; and the phenomena of what is termed (in language apparently borrowed from St. Paul) 'hysteresis'—the varying ease with which iron, steel, and other metals can be magnetized, and the diminishing

succession of magnetic cycles needed for demagnetization—afford very suggestive examples of how quantitative formulae can be derived for what are essentially processes of ‘conditioning’ and ‘deconditioning.’ Some such additional principle must surely be included in our scheme, unless we are to ignore the most characteristic effect of mental stimulation. A theory which interprets *g* solely in terms of sampling would find it hard to explain the inner working of any test of educability, and harder still to show how the structureless pool of the mind, by merely repeating the sampling process, can ultimately be turned into an organized system of subpools.

But Prof. Thomson does not propose to explain test-performances solely in terms of sampling; and he is by no means unaware of these further problems. Indeed, if, on a first perusal, the reader thinks he has discovered a grave objection to the theory, he may be warned to re-read the relevant pages with care: more often than not he will find Prof. Thomson has anticipated the difficulty and even tersely hinted how it can be met. In an introductory work, the primary object of which is to give a comprehensive and impartial survey of the whole subject, suitable for the elementary student, the author has rightly kept his own interpretations modestly in their place. We shall all, however, look forward with the greatest interest to the further elaboration of his views which he seems to promise. Meanwhile, the present volume not only gives a lucid and unbiassed account of the different theories and methods that have hitherto been advanced, but also, as I have tried to show, raises a number of interesting and important issues which factor-analysis has still to answer and on which the thoughtful student can reflect and perhaps research. Both to investigators in this special field and to every teacher or educationist who wishes to think with precision about such questions, the book is indispensable. It is a splendid culmination to twenty-five years’ work, and at the same time supplies a solid foundation for work that is yet to come.

CYRIL BURT.

THE SPENS REPORT.

(Report of the Consultative Committee on Secondary Education with special reference to Grammar Schools and Technical High Schools. His Majesty's Stationery Office. 3s. 6d.)

THE latest report of the Consultative Committee is likely to become as famous as the Hadow Report, to which indeed it may be regarded as a sequel. Like its predecessor it has appropriated the name of the Chairman of the Committee, and is already known to the public as the Spens Report. Its terms of reference are narrowly defined. They limit the deliberations to "the organisation and inter-relation of schools, other than those administered under the Elementary Code, which provide education for pupils beyond the age of 11+; regard being had in particular to the framework and content of the education of pupils who do not remain at school beyond the age of about sixteen." The Committee was, therefore, supposed to leave out of account about 85 per cent of post-primary pupils and confine its attention to those who attend secondary schools and vocational schools. As a matter of fact it did not so limit its purview, though it cannot be claimed that it has dealt adequately with the residuary 85 per cent.

Its own special theme, however, together with all matters which throw light upon that theme, is treated with a thoroughness which compels one's admiration. The Report is erudite and at the same time infused with a generous and democratic spirit. The first chapter is a long and learned historical sketch. It traces the development of the secondary school curriculum in England and Wales, and shows that there has been no single and simple line of evolution but rather a series of sporadic attempts to relate school studies to the life of the times. Since the days of the Renaissance the non-local Grammar Schools, as the Report designates our public schools, have exercised a conservative and stabilizing influence over the trend of secondary education in general, and have resisted all efforts to adjust the school curriculum to meet the needs of an ever-changing social environment. They clung stubbornly to the theory that the study of language is the main standby of a liberal education (a theory which is probably sound), and that the study of language is always best approached through Latin and Greek (a theory which is certainly unsound). Other schools, opened by Nonconformist bodies or by private enterprise, afforded a broader and more progressive training, but were regarded as experimental. In any case they lacked

the prestige of the public schools. The upshot is that even at the present day the curriculum of the Grammar Schools, both local and non-local, has been unduly influenced by the traditional curriculum of the public schools.

This historical chapter, for which the Secretary, Dr. R. F. Young, is mainly responsible, is supplemented by a very illuminating appendix for which he is wholly responsible. It deals with the conception of a liberal education. The term "liberal education" derives from the days of Greek and Roman civilization, which was based on slavery. A liberal education was simply the education of a freeman. It excluded the illiberal arts, the mechanical occupations pursued by slaves. As freemen alone were concerned with the government of the state, they alone needed to understand the duties and privileges of a citizen. In these days of universal suffrage it is reasonable that a liberal education should be defined as in the Report: "Such an education as will enable men and women to understand the world in which they live and to contribute to the understanding of its problems." It is interesting to note that two quite different (and quite erroneous) interpretations have been given to the term. One connects it, not with the adjective *liber*, free, but with the noun *liber*, a book, thus making a liberal education mean a bookish education. The other interpretation gives "liberal" the modern meaning of generous, abundant, and makes the term "liberal education" signify one which is broad and comprehensive.

The Committee regard the distinction between liberal and vocational education as invalid. Their Secretary quotes with approval Professor A. N. Whitehead's pronouncement: "The antithesis between a technical and a liberal education is fallacious. There can be no adequate technical education which is not liberal, and no liberal education which is not technical . . . In simpler language education should turn out the pupil with something he knows well and something he can do well." The curriculum of the Grammar School is vocational in that it trains the pupil for a university career, and ultimately for one of the learned professions; the curriculum of the Technical School is liberal inasmuch as it helps the pupil to understand the world in which he lives and in which he will earn a living. One is the less surprised therefore to find, among the Committee's recommendations for Grammar Schools, one which is enough to make Arnold and Thring turn in their graves: "In areas in which many pupils leave at, or shortly before, the age of sixteen to obtain clerical posts in industry and commerce, opportunities to acquire the mechanical skills of typewriting and shorthand should be given them after the age of fifteen."

To balance this we find a recommendation that in all secondary schools, whether academic or technical, the training between the ages of eleven and thirteen should be of a broad liberal character.

The Report allots space to a discussion of the influence of Modern Psychology on traditional ideas about the curriculum. It specially mentions the changes in our conceptions of the general effect of special training, and of the nature and growth of intelligence ; and it appends two admirable memoranda which should be of particular interest to the readers of this journal. One, by Professor Cyril Burt, deals with the history of faculty psychology ; the other, by Professor H. R. Hamley, deals with the cognitive aspects of transfer of training. In the light of these memoranda it is clearly seen why Latin lost its dominance over the curriculum and why the curriculum has been enriched by the inclusion of a larger variety of subjects.

The Hadow Report presented us with an ideal of secondary education for all—a very different thing from grammar school education for all. That ideal is reaffirmed by the Spens Report. All post-primary pupils, without distinction of intellectual or social standing, are to receive the secondary education which is their due. *Parity* is one of the key-words of the Report. There is to be parity of status for the schools, parity of opportunities for the pupils, and, with certain reservations, parity of payment for the staffs. All post-primary schools are to be administered under the same Code of Regulations and are to have equal facilities and equal amenities. The classes are to be equally small (thirty is the number mentioned), the premises equally commodious, and the equipment equally generous. No differences are to be allowed unless they are necessitated by differences in the curriculum.

The great practical problem in the education of adolescents will be to take the multitudinous eleven-year-olds (there are close on half a million of them) who emerge every year from the primary schools and distribute them among the various types of secondary schools. It is a question of selection and distribution—if the schools are there. But they are not there ; not as envisaged by the Committee's two idealistic Reports—that is unless we are to believe that the Committee is content with the three categories repeatedly referred to in the Spens Report : the Grammar Schools, the Technical Schools, and the Modern Schools. It suggests changes in the curriculum of Grammar Schools and in the organisation of Technical Schools, but it seems to be content with the proportion of children who attend these three types of school. At present 13·7 per cent of the eligible age-group in the elementary schools pass on to Grammar Schools. The Report suggests raising the average to fifteen—

a trifling change. It hazards no estimate of the number that should go to the Technical High School, the new type of technical school which it is proposed to establish. The numbers attending all schools which may broadly be termed technical are not large. Even in London, which is reputed to be best supplied with these schools, the percentage is only about 4, and that percentage is reached not at 11+ but at 14+. At 11+ the children are distributed among two types of schools only, the Grammar Schools and the Modern Schools, and in the proportion of 15 to 85. Eight-five per cent of adolescents from eleven to fourteen years of age attend Modern Schools, and these schools are frequently referred to as though they were all of the same sort, and were all as homogeneous as the Grammar Schools and the Technical Schools. Are we to take this 85 per cent as constituting the undifferentiated residue, a group awaiting finer classification as soon as we can achieve it; or are we to take it as constituting a final type of school from which there is to be no further split? As a matter of fact in a large number of areas the schools have settled the problem almost for themselves; at any rate with but little help from the central authority. In London and Manchester and in many other areas, rural as well as urban, Modern Schools are of two types, selective and non-selective. And between these two there is a world of difference. They are generally known as Selective Central Schools and Senior Schools respectively. And it is a serious flaw in the Spens Report that it does not properly distinguish between them, and does not give the Selective Central Schools the full credit of their achievements. It brackets both under the common name Modern School. Why they are called "modern" it is difficult to say, for the Selective Central School is nearly thirty years old, and the Senior School is about as old as the elementary school itself. Besides, the common name disguises the wide disparity in their characters. The selective Modern School (to use the nomenclature of the Report) is often, in the intelligence of its pupils, the quality of its work, and the qualifications of the staff, indistinguishable from a good Grammar School; while the non-selective Modern School, having been twice robbed of its brighter pupils, is inferior in its intellectual resources to the top half of the old elementary school.

The inconvenience of using the same term for two such different schools is specially evident in the section dealing with "the combination of a Grammar School with a Modern School in one set of buildings," a policy that is recommended for areas with a sparse population. It is conceded towards the end of the section that "the organisation of a combined school will prove to be more efficient in actual operation if

the modern side is of a selective character." Of course it will, for the school will still be a fairly homogeneous Grammar School; the other alternative produces a multilateral school where the sides are so small that it will be, in every sense, expensive to work.

The detailed recommendations of the Report, since they are by no means likely to be carried out in the near future, need no further consideration here. The Report itself, however, with its ample discussion of general principles, and its fair-minded presentation of *pros* and *cons*, stands as an up-to-date treatise on education, a treatise both informative and inspiring. Though most of it is nominally concerned with a limited group of children—those between eleven and sixteen years of age—the principles discussed and promulgated cover a much wider field. It well expresses certain ideals cherished by the most enlightened and most earnest members of the teaching profession to-day. I specially refer to a unified profession, a unified system of education, and the provision for each child of an education in accordance, not with his capacity to pay for it, but with his capacity to benefit by it. The book does not perhaps always indicate the best way in which these ideals may be embodied in practice, but there will never be in the reader's mind any doubt as to the objective the Committee had in view, nor any doubt as to the rightness of that objective.

P. B. BALLARD.

OUTLINES OF RESEARCHES REPORTED IN THESES PRESENTED FOR HIGHER DEGREES OR DIPLOMAS.

THESE OUTLINES MUST BE SUBMITTED THROUGH THE HEAD OF
THE DEPARTMENT IN WHICH THE RESEARCH WAS CARRIED OUT.

The Sense of Humour in Childhood and Adolescence.

*An Abstract of a Thesis presented for the degree of Ed.B. in the University
of Aberdeen, June, 1938.*

By ALEXANDER LAING, M.A., Ed.B.

A STUDY was made of the differences in the sense of humour (discernment of the laughable) of children from the beginning of the primary-school stage to adolescence. Data were obtained from 709 boys and girls, divided into three age-groups: 7-10, 200; 11-13, 283; 14-18, 226. The subjects causing laughter in the youngest group were investigated orally. The children in the second group wrote for an hour on any of the following subjects: (1) Amusing things I see about me; (2) The most amusing experience I ever had; (3) Comical people I have seen (in the street, in films, etc.); (4) Comical people I have read about. Similar essay-subjects were given to the children in the third and oldest group, together with two new topics, "My sense of humour" and "What makes me laugh," which were included to give the adolescent tendency to reflection an opportunity to express itself, and were actually chosen by 40 per cent of the group. To supplement these inquiries into visual humour, the children's appreciation of verbal wit was studied by asking them to give their best jokes.

Development of the sense of humour was found to run parallel with general intellectual and emotional development. Deviations from the normal and conventional were outstanding causes of laughter in the youngest group. Incidents involving someone's discomfiture (which were also popular in the youngest group) were those most frequently referred to by the children in the second group. The humour of both these groups was predominantly visual; verbal wit was little appreciated. Distinguishing features of the adolescents in the third group were: (a) the marked individual differences in their sense of humour—although many no longer tolerated slapstick farce and preferred witty and realistic comedy, others enjoyed both, and others, again, gave as their best jokes fatuities that were popular among children in the youngest group; similarly, although several relegated the laugh of Hobbes' "sudden glory" to an inferior category, many gave first place to humour of this type; (b) their much greater appreciation of verbal wit; (c) the tendency of the majority to reflect on why they laugh, and of a minority (especially among the girls) to deprecate laughter that is unfeeling.

BOOK REVIEWS.

The Development of Children's Concepts of Causal Relations: By JEAN M. DEUTSCHE. (pp. 104. 9s.)

The Development of Linguistic Skill in Twins, Singletons and Siblings, and only Children from age five to ten years: By EDITH A. DAVIS. (pp. 165. 9s.)

The Effects of Praise and Competition on the Persisting Behavior of Kindergarten Children: By THETA HOLMES WOLF. (pp. 138. 9s.)
All published by the University of Minnesota Press, Minneapolis, Humphrey Milford, and Oxford University Press,

These three books constitute the *Child Welfare Monographs*, Nos. 13, 14 and 15 respectively, edited by the Director of Minnesota Institute of Child Welfare, Dr. John E. Anderson, who writes a brief foreword to each. Like others of this series they are characterised by an evident desire, first, to establish clear facts about child development, and by an absence of any selecting of facts to fit a particular theory, and a ready recognition of the limitations of the particular investigation.

The enquiry as to children's concepts of causal relations deals with 732 children between the ages of eight and sixteen. Questions were put to the children on such topics as follows: What makes the wind blow? What makes the snow? Why do boats float on water? What causes thunder? etc., and a number more decidedly of a type that might occur in early school work in general science. It is important to bear in mind the type of questions put because it no doubt explains several of the main findings, more particularly the surprising result that there was only a small connection between the scores and estimated intelligence, within any given age group; whereas the relation between score and school grade (age being held constant) was considerably higher. As the author points out: "This suggests that the answers to these questions are more directly determined by factors involved in school experience than they are by intelligence."

The author emphasises the great influence which the particular content of the question has on the type of the answers given and concludes that results contradict some of the main findings of Piaget on this topic. A final point of interest is that the small group of kindergarten children show surprisingly high scores.

The second study, dealing with linguistic skill, was based upon experiments with over 400 children of whom 166 were twins and 97 only children. Due attention was paid to the distribution of the children in different social grades, and also to the length of schooling. Various interesting toys and "play situations" were arranged and the children were encouraged to talk about these. Their remarks form the substance of the material for analysis, for an estimate of talkativeness, and so forth.

The main conclusions were as follows:

- (1) Only children are definitely superior to children with siblings in every phase of linguistic skill (even allowing for the greater frequency of only children in upper social classes).
- (2) Singletons with siblings are in turn somewhat superior to twins.
- (3) Twins from the upper occupational groups by $9\frac{1}{2}$ years have practically overcome their language handicap, but twins from the lower occupational groups have made relatively little progress.
- (4) Twins of the ages studied in this investigation are especially retarded in perfection of articulation. The inferiority is marked during the kindergarten period, particularly in twins from the lower occupational groups.

The third of these books deals only with five-year-old children in the kindergarten school. The tasks given them were the setting up of various toy models, a game of toss with quoits, putting pins into a peg board with a pair of tweezers, an automatic, repetitive task, namely, a cancellation game in which, in pages of

figures, all the dolls and only the dolls had to be crossed out. Finally there was the dull task of dropping little lead balls into a box through a small hole. Three different types of incentives were used; the first was simply that intrinsic in the material itself; secondly, praise was given for success; third, there was a competitive situation set up, four children being picked at a time and urged to compete with one another. With regard to this last the author wisely points out that it is "impossible to know how much of the increased performance should be attributed to competition and how much to mere sociability." For four of the five tasks the effectiveness of the stimulus increased in the following order: first the task without added incentive; second, praise by the experimenter; third, competition. Praise was considerably more effective with the quoits than with the other three tasks. Competition showed a greater influence relatively on this very game of quoits. It also specially affected the two simple repetitive tasks of cancellation and dropping balls into the box. The author concludes then that the effectiveness of incentives is limited by the nature of the tasks performed. One outstanding example was the difficult construction problem of the "tinker toy." "The results of this study suggest that persisting behavior is both general and specific. There is a low but positive relationship between persisting performances in different tasks and different incentive situations." C.W.V.

Introduction to Experimental Psychology (third edition, enlarged and revised): By C. W. VALENTINE. (London: University Tutorial Press, Ltd., pp. x + 283, 4s. 6d.)

Since Prof. Valentine's manual was first published, the introduction of a course of practical psychology into the curriculum for students who are being trained as teachers has become far more general. In reviewing the previous edition in *The Forum of Education* it was pointed out how seriously such proposals were handicapped by the lack of an appropriate textbook of experimental exercises. What is needed is a cheap and handy volume well within the limited means of the elementary student; the exercises should be suitable for large classes carrying out the experiments in groups of twenty or thirty at a time; they should involve no costly apparatus, and pre-suppose no laboratory expensively equipped. This book is the only publication in this country which fulfils these requirements; what is more, it fulfils them so well that no other book has been needed or attempted. That after nearly a quarter of a century the demand for it is still so great as to justify a third edition is, of itself, a high testimony to the merits of the work.

In the meantime, psychology has progressed. And in no other field has it advanced so rapidly as in its application to educational problems. The new edition comes into step with these changes. Fresh chapters have been added, dealing more especially with the topics of perception, apperception and imagination, accuracy of report and susceptibility to suggestion, and the intuitive judgment of character and intelligence. Many of the older experiments and tests have been revised or supplemented in the light of recent work on backward and subnormal children, and admirably bring home to the beginner the value of more scientific methods in studying such cases. To help the teacher to evaluate his own tests and examinations, experiments have been inserted to explain the nature of correlation and its use in schools; and the discussion on general intelligence and group factors has been brought carefully up to date. The chapters on attention and memory have been revised and extended: the latter now includes new experiments suggested by Prof. Bartlett's book on *Remembering*. The invasion of psychological methods into unexpected fields is illustrated by experiments on the appreciation of colour, poetry, pictures and literary style.

The book as a whole is at once so sound and comprehensive that it should be of value, not merely to the intending teacher, but also to the student of general psychology who needs an elementary introduction, and particularly to those who are studying it at home or as external students without access to laboratory facilities or a trained instructor. In a subject where so much is published which the beginner need not and should not read, the selected references in the footnotes and the classified bibliography at the end will be found particularly helpful. Even the

advanced research worker may profit by the numerous original and suggestive comments scattered through the pages (e.g., the much needed advice "to approach the study of mental types rather by analysing the more intellectual material of ideas than by the study of the vaguer temperaments") and by the concise summaries of results reached by Prof. Valentine himself in important educational fields.

The teacher of psychology will benefit most of all. With a sure flair for what is soundest and most suggestive in modern psychological theory, Prof. Valentine combines a long experience of the practical needs of the elementary student. Every instructor, therefore, who has to devise an experimental course in the subject will be particularly grateful to him for thus placing both his knowledge and his experience at their disposal.

C.B.

Human Nature at Work: By JEAN L. SHEPARD. (Sir Isaac Pitman and Sons, Ltd., 1938, pp. xi+219. 7s. 6d. net.)

The American people has now to a large extent completed the conquest of the physical features of its territory, and its pioneering energy is pushing ever more strongly forward along a front where even greater triumphs are to be won. The problem of how people are to live and work together happily in groups is receiving more and more attention, not merely by psychologists but also by business men, who, in America at least, have proved to their own satisfaction that its successful solution brings a return in dollars and cents.

This book is an excellent example of the propaganda now being devoted to the improvement of human relations in business. The author claims that she, along with other personnel workers in America, has gone far beyond European ideas, which tend to represent the individual worker as a "physical entity that needs care like a machine," to the study of emotional factors in human beings at work. It is these factors more than any others which determine the success or failure of an individual, and the author develops this theme in a very readable series of case histories supported by general observations on the principles involved.

One short extract will serve to indicate how the author can give a stimulating interpretation of the simplest of everyday situations:

"One executive said he always sat at his desk and wondered why the people on the other side were so ill at ease, although he did nothing consciously to put them at a disadvantage. In truth, his manner was impeccable. . . . One day he happened to be engaged in the centre of his office and found that, without his position behind the desk, that symbol of authority, he was not himself. Something was missing from his usual comfort and security.

"This interested the executive so much that he decided to try the experiment of giving the other fellow a chance on an equal footing. He remodelled his office, making it a simple living-room with a small sofa, comfortable chairs, tables placed for convenience, but no desk. He met everyone directly as man to man, and was gratified at the spontaneous expression and change of ideas that resulted."

Similar insight is brought to bear on a large variety of other problems, from the interviewing of applicants to the treatment of older employees whose ways are set; and although the book may be read once for sheer interest, it should be read several times by anyone set in authority, to ensure that the maximum profit is obtained from the sympathetic discussion of so many human difficulties.

E.P.H.

The Riddle of Life: A Survey of Theories: By WILLIAM McDougall. (Methuen, 1938, pp. 279. 7s. 6d. net.)

It is sad to think that this is the last book McDougall lived to write, but it is a fitting coping stone to his teaching during almost fifty years. For in it he gives his final conclusions about the difference between living and material things, a question which had been the theme of his earliest works and with which all his writing had been more or less connected.

Most of the book is devoted to a critical summary of the chief answers which have been given to this question in recent years. He discusses briefly but incisively mechanical biology, emergent evolution, and holism, insisting everywhere on the reality and importance of psychical teleological activity. "The psychical factor in the life of organisms is of their very essence, and throughout the scale of organic evolution it has become of increasing efficiency" (pp. 236). The conception of a living organism which he himself prefers is that of a hierarchy of monads in which physical and psychical activities, though connected with each other, are radically different. His account of monadic and dualistic theories is therefore more sympathetic.

In spite of the physical disabilities under which the book must have been written we find the clarity and vigour of statement, the wide knowledge and flashes of insight, and whole-hearted pursuit of truth which we have learned to expect from his other works. If the limits of his space and a certain lack of philosophical rigour lead us to feel at times that there is more to be said than he implies, he has, at any rate, given us an illuminating introduction to the study of a problem which is fundamentally important in biology, psychology, and philosophy. His masterly statement of his own views and broad survey of other theories will serve as a valuable guide to readers making their first acquaintance with a field which is being actively explored, and will be welcomed by those to whom his main conclusions are familiar.

H. B. S.

Studies in Clinical Psychology: Edited by LEE EDWARD TRAVIS; and *University of Iowa Studies in Psychology No. 22*: Edited by CHRISTIAN A. RUCKMICK. (Psychological Review Co., Princetown, N.J., pp. 250. \$6 30 cents.)

This volume includes a number of doctoral theses involving an analysis of stuttering and the neurophysiological processes underlying voluntary conditioned reflex and reflex behaviour in man. The data seem to warrant the following conclusions, among others: (1) a decrease in efficiency of eye movements in stutterers during stuttering seems to be a reaction to difficulty present in one of three physiological mechanisms used in the speaking act, viz., verbalization; (2) two general forces—the reaction to social confrontation, and the ontogenetic factors surrounding the malady of stuttering interact with the neurophysiologically susceptible organism of the stutterer and produce stuttering in those situations where the three are present to a sufficient degree; (3) susceptibility of the stutterer to changes in the speaking situation is suggestive of the efficacy of a therapy which will increase his ability in social confrontation and develop within him a more objective point of view towards his disorder.

Psychology and the Religious Quest: By Dr. R. B. CATTELL. (Nelson, pp. 190. 2s. 0d.)

One of the aims of this book is to show that certain scientists who have, to their own satisfaction, exploded religion do not go far enough. Dr. Cattell believes that the logical outcome of the theory of the group mind is something to which men in the past have given the name God, but which he calls the Theopsyché. He traces the relation of man to this in the field of morals and ethics, and insists that this consideration is urgent to-day.

His dismissal of present-day religious beliefs is confidently dogmatic, but his remarks on some of the values of religion are sympathetic. He gives a brief but interesting survey of the evolution of certain religious beliefs as shown by anthropologists.

Many who do not agree with his position will do well to consider his plea that the psychological investigation of religious problems, especially among youth, is a pressing need to-day. His sympathetic insistence that religion needs to be considered scientifically gives much value to this book.

T. A. G.

The London Head Teachers' Association, 1888-1938. (University of London Press, pp. 143. 3s. 6d. net.)

The London County Council celebrates its own jubilee with proper pomp this year. The London Head Teachers' Association came into being a year before the L.C.C., and has celebrated its fifty years of existence by the publication of a jubilee souvenir book. There are something like fifty illustrations, old and new, ranging from the infant galleries, the massed classes and massed drills, the flowing robes and fierce moustaches of the old-time staffs, to the open-air agility, the health services, practical activities, physical education and unobtrusive teachers of to-day. The period covered by the record, half of it pre-war, saw "the transformation of the whole London working population from a semi-educated to an educated community." When the L.H.T.A. began, payment by results was still in operation, a superannuation scheme was still to come, and, as Mr. Rich's foreword notes, teachers had only recently ceased to be stoned in the streets as they went to and from their schools.

The Secretary, the President and others survey the half century of the Association's activities, and the book is fortunate in its guest-artist contributions. The Education Officer writes a sympathetic foreword, the Leader of the Council (Mr. Herbert Morrison) pays tribute to the elementary school, and four racy chapters are contributed by well-known officers, past or present, in the Council's educational service. Mr. George Sampson has some wise and mellowed reminiscences of pupil-teacher times, with a side glance at young men and women of to-day who "sometimes go gracefully through the motions of teaching before their classes and feel that their responsibility is thus discharged." Dr. Ballard notes from personal experience that during the fifty years the normal size of classes has been halved. Professor Burt maintains that education is quickly turning from an art into a science and that the teacher, who in the first half of the period under review had become more human, has in the second half of it become more scientific, without any sacrifice of his humanity. "The old teacher ruled his pupils; the new teacher studies them." Dr. F. H. Spencer writes in lively vein about inspectors, both the H.M.I. and the L.E.A. type, having himself had experience of both kinds. He is "not at all convinced that to leave teaching for inspection is calculated to increase the happiness or the comfort of those who make the change." An inspector has to be "a good arbitrator, a good diplomat, a good speaker, and, in general, a kindly, resolute, intelligent, imperturbable archangel."

The special chapters bring out the fact that there are now nearly as many pupils in the L.C.C. Selective Central Schools as in the public Secondary schools of London. Technical education, the evening institutes and the day continuation schools are briefly dealt with, though there is no reference to the Literary Institutes—a special feature of the London system. In general, however, the book is a comprehensive and very readable record of "fifty glorious years" of educational service.

A.E.D.

The Nineteen Thirty-Eight Mental Measurements Yearbook. Edited by O. K. BUROS. (New Brunswick: Rutgers University Press, pp. 415, \$3.)

For several years Professor Buros has been regarded as one of the best friends of psychologists engaged in measurement. His *Educational, Psychological and Personality Tests* of 1933, 1934 and 1935 is a bibliography of eighty-three pages. His corresponding volume for 1936, containing critical reviews of tests by experts, runs to 141 pages. Now, however, the tremendous activity of test technicians and writers of books on mental measurements has made it necessary to expand the scope of the service to the extent of 415 pages. According to a conservative estimate there are over two hundred psychological tests standardised every year in the United States alone, and as this Yearbook also reviews books on mental measurements, research and statistical methodology, etc., for the whole of the English-speaking world, it is clear that the task of keeping abreast of the times without its aid is almost hopeless.

On the front of the jacket appear the names of 135 expert test reviewers from the universities and colleges of the United States whose co-operation was enlisted. Review excerpts from 185 journals in English-speaking countries are presented so as to assist readers in making selections from among the hundreds of books and tests published. One outcome of this Yearbook will be to impel test authors and publishers "to construct fewer and better tests and to furnish a great deal more information concerning the construction, validation, use, and limitations of their tests." As the editor points out: "Test users have every right to demand that test authors and publishers present full particulars concerning the methods used in constructing and validating the tests which they place on the market."

For each test the following particulars are given: title, author, publisher, group for which it was constructed, date, cost, working time, and references. Already the editor has in view still further improvements for the 1939 Yearbook, such as a more adequate representation among the reviewers of able classroom teachers.

The venture deserves every encouragement and it is fervently to be hoped that the requisite finances will long be available to enable Professor Buros and his staff to continue these ambitious and helpful activities. LL.W.J.

The Industrial Worker: By T. N. WHITEHEAD. (Oxford University Press. Vol. I and II. 21s.)

This is in many respects a monumental book. It represents twelve years' work, during six of which a group of five girls worked under the closest observation in an experimental test room devised and maintained by the Western Electric Company at Hawthorne. Except that the girls were carrying out a very routine industrial assembly job, the conditions of work were unlike those in modern industry, and approximated to those of the small family industry of earlier times.

The part of the experiment that appealed to the girls most was the fact that "We was told to work as we feel and we do," but as every teacher knows, there are limits to this attitude. In this small group of five two Polish girls badly upset the whole social atmosphere. Output suffered. They were removed at the end of the year.

In their place came two friends, one Italian, a dominant personality. She realised that the experiment, which was under the eye of the Executives, was not coming up to expectations, and soon discovered subtle ways of speeding up the group. Output increased and everyone was pleased, but the pace got so hot that the leader herself exclaimed: "I always get so nervous that I cannot stand it. Everything must be done in a hurry. . . ."

The inevitable reaction that followed was accentuated by the fact that management's interest had turned towards a new enquiry. The leader was disheartened, the girls became irritable, complained of the ventilation, their supervisor, and were even suspicious of the accuracy of their pay.

The last part of the book shows by an elaborate statistical analysis of the records and comparisons with the remarks of the girls, that friendships and hates operate in industry in much the same way that they do in school. Little social groups form, break up, and individual work is influenced accordingly.

With such a small group doing work in which boredom was the greatest enemy, social factors were bound to dominate the situation and North Whitehead has done heroic work in rescuing the facts from a prodigious welter of records.

G.H.M.

Psychology of Music: By CARL E. SEASHORE. (McGraw-Hill, pp. 408. 24s. 0d.)

This work is a retrospective synthesis of the results of forty years' research in the psychology of music, a research conducted in laboratories equipped with every modern scientific device for the accurate measurement, recording and graphical representation of the most minute modifications in pitch, intensity and timbre throughout the duration of any sound, a research conducted by a body of enthusiastic experts, inspired by the direction of Professor Seashore. It is obvious, therefore, that such a work must be regarded as a landmark in the history of the psychology

of music. A fundamental hypothesis is that "the medium of musical art lies primarily in artistic deviation from the fixed and regular," and that, therefore, musical performance is capable of quantitative measurement in terms of deviation from the "true" in each and all of the four attributes of sound: pitch, intensity, duration and timbre. In addition to extensive records of such deviations, the work includes an interesting analysis of the quality of timbre, and differentiates the timbre of all the main orchestral instruments by contrasting their timbre spectra; the timbre of the bassoon is treated in detail. Further, the whole range of musical ability, innate and acquired, is discussed, with factors implied in training, and a chapter is added on musical aesthetics. The work is generously illustrated, includes a large number of statistical records, and an extensive bibliography.

To those who have opposed the extravagant claims of the empiricists the work contains a welcome expression of the limitations of the scientific and objective approach to the study of what constitutes goodness in music. A science of music is essentially a science of musical performance, superimposed on the creative work of the musician, and the merits of a particular work are clearly distinct from those of a particular interpretation of it. Only the latter is capable of exact measurement; the former, like the beauty of a poem, is an elusive value outside the domain of the scientist.

J.M.

Play in the Infants' School: By E. R. BOYCE. (Methuen, pp. 185. 5s.)

The reorganisation of a school is an enterprise demanding skill and courage. Miss Boyd's account of her experiment in the Raleigh Infants' School shows that she lacked neither.

The children in this East End school suffered from the physical ills and the mental stunting common to small slum dwellers. The existing school curriculum failed to meet the real needs of the children and Miss Boyce, with good reason, rejected the "project" method. So the children were given freedom to develop their abilities and to acquire mental and physical poise through their self-directed activities in an environment designed to compensate, in some degree, for the deficiencies of their homes. The experiment is important as a considered attempt to meet the special needs of a particular group of children.

Miss Boyce's description of their activities—shop-keeping, cooking, construction, imaginative play, and their delightful and vigorous performances in the school theatre—conveys the impression of their eagerness and concentration, and shows how wide an experience can be gained through play. Moreover, it provides additional material for the study of the play of young children.

In the last section of the book the introduction of formal learning is described and the attainments of the children are frankly discussed. The reports suggest that in speech, dramatic ability, and mathematical skill they surpassed children from similar homes in schools of a more orthodox type. Their eagerness to learn and their wider background would compensate for deficiencies of achievement in reading.

An Educational Failure: a School Inspector's Story: By F. H. HAYWARD. (Duckworth, 1938, pp. xvi+379, 7s. 6d. net.)

Dr. Hayward has long been known as an enthusiastic advocate of school celebrations, which, he believes, might revolutionise our ethical and religious teaching. It must be admitted that his drastic criticism of the kind of teaching now given in some schools and churches is not without justification, though his strictures are far too sweeping. We may also agree the type of celebration he recommends has been unduly neglected. Whether it could achieve all the results he claims is much more doubtful, but if he had given us a reasoned account of its theoretical basis and systematic suggestions for experimenting with it, his book might have been suggestive and practically useful. Unfortunately it is concerned mainly with his failure to induce the London County Council to organise school celebrations on a comprehensive scale. It is written under the influence of his sense of disappointment, includes much that is only of personal or passing interest, and cannot be said to make any serious contribution to the discussion of a movement with attractive potentialities.

H.B.S.

Your Life's Work: By E. D. LABORDE. (London: Thornton Butterworth, 1939, pp. 223. 5s.)

Some years ago Dr. Laborde, who is a careers master, wrote a book on occupations, which was probably found by many people to be a useful one. Unfortunately, the same cannot be said of this production. From its first paragraph—which seems to defy grammatical analysis—to its last, it is blemished by dogmatism, misconception, mis-statement and a number of other qualities which are perhaps even less desirable in the writings of careers advisers than in those of ordinary mortals. Several of these characteristics can be discerned without difficulty in the brief passage (on page 154) in which Dr. Laborde deals with the psychologists' contribution to the problem with which he himself is primarily concerned.

"In recent years there have come into existence a number of methods of vocational testing, which claim to treat the boy as a subject and at the end of a series of processes to announce the careers for which his bent and talents fit him. Such tests are widely used in firms whose recruits are unable to produce a house-master's summary of character. As, however, they are largely formed on the collated estimates of character as given by parents and schoolmasters, they are unnecessary when the schoolmasters are capable of giving their own judgments."

A.R.

Alcohol and Human Life: By Dr. COURTENAY C. WEEKS, with Foreword by Sir Thomas Barlow, Bart. (H. K. Lewis and Co., Ltd., 1938, pp. 454. 6s.)

This work is partly a revision of *Alcohol and the Human Body*, by the late Sir Victor Horsley, the late Dr. Mary Sturge, and others. In the opinion of the author alcoholic indulgence is still the greatest single enemy that Britain has to fear, the one which "allies itself with all that mars and spoils human life," and an impressive collection of social and scientific data is assembled here to support that belief. An important chapter is the one dealing with alcohol and motor driving, in which the effects of small doses of alcohol on motoring efficiency are discussed. These effects show themselves in diminished powers of attention, concentration and sense of anticipation and responsibility. There is interference with central and peripheral vision, and there is also an inaccurate and slowed response to emergency impressions.

In view of the fact that owing to the sense of well-being caused by alcohol there is an uncritical satisfaction with these faulty psycho-physiological conditions, total abstinence before and during motoring and flying appears to be essential.

Sex, Friendship and Marriage: By K. C. BARNES and G. F. BARNES. (George Allen and Unwin, pp. 199. 6s. net.)

This book gives a popular discussion of various problems of love, courtship and marriage, together with a more technical appendix dealing with the physiology and anatomy of sex development. The discussion is on the whole marked by good sense, and would be useful reading for a good many young men and women, although I doubt its value for older boys and girls, which is suggested on the back cover. Furthermore the technical nature of the appendix, which occupies about one-third of the book, lessens the unity of the book, and some parts of the appendix seem to be quite unnecessary for those who would clearly be interested in the main part of the book.

High, Wide and Deep: By C. MADELEINE DIXON. (George Allen and Unwin, pp. 300. 12s. 6d. net.)

The sub-title of this book, *Discovering the Pre-School Child*, indicates broadly its purpose. It is a somewhat diffuse description of work and play in the nursery school, with a good deal of discussion, and some popular and not too well established psychological interpretations. It will, no doubt, be quite suggestive to teachers of nursery school and infant pupils.

Modern Trends in Education: Edited by A. E. CAMPBELL. (Oxford University Press, pp. 489. 10s. net.)

This volume gives a full report of the proceedings of the New Educational Fellowship Conference held in New Zealand in July, 1937. Even to mention the topics dealt with by the authors would mean a somewhat long review. There are, indeed, twelve sections, with something like half a dozen or more topics in each section.

Naturally, therefore, the various topics are only dealt with very lightly, and in some cases only occupy a few pages; but they do indicate what the speakers thought the most important points under the different headings.

The authors include Dr. Cyril Norwood on "Christianity and the World Crisis"; Dr. I. L. Kandel on "School and Society, and Administration"; Dr. Susan Isaacs on "The Pre-school Child" and "Infant Education"; Dr. Wm. Boyd on "Various Aspects of Examinations"; Dr. E. de S. Brunner on "Rural Life and Education"; and a substantial section on "The Education of the Adolescent," which includes contributions by Mr. E. Salter Davies and Mr. G. T. Hankin.

The Hearing Abilities of Children in Toronto Public Schools: By CLIFFORD B. CONWAY. (Toronto University Department of Educational Research, pp. 132. 75 cents.)

After discussing the mechanism of hearing the author describes an audiometer which was devised by himself.

Out of a group of 1,000 children tested by the audiometer, 962 were considered representative of the upper three grades of Toronto public school children. Of these, 10.6 per cent were hard of hearing, 7.9 per cent in one ear, and 2.7 per cent in both ears. These numbers proved to be three times as high as the estimates made by persons in charge of the children. More boys than girls were found to be hard of hearing, since twice as many boys as girls had high frequency deafness. This suggests the possibility of sex linkage in the inheritance of deafness. The author quite rightly emphasises the great importance of accurate testing of the hearing of children as defects are more frequent than is generally realised.

Sex in Childhood: By Dr. ERNEST R. GROVES and GLADYS H. GROVES. (Frederick Muller, pp. 254, 5s. net.)

The authors of this book have already produced between them eleven books dealing with marriage, family problems, etc. The present book is written in a popular style and includes a good deal of sound sense when dealing with the later stages of childhood and adolescence. There is however a good deal of surmise and guesswork, and there are some fantastic ideas, in the earlier part. It is likely to be of little value to serious students of psychology.

OTHER PUBLICATIONS RECEIVED.

- Der Radio Detektiv*: L. Roggeveen. (Macmillan and Co., 2s. 6d.)
- Graded German Composition for School Certificate Forms*: W. J. Hearn. (Macmillan and Co., 2s. 6d.)
- Prose Selections with Exercises*, 3rd year: W. Alderton Pink (Macmillan and Co., 2s.)
- French Songs*: arranged by Sir Walford Davies. (Macmillan and Co., 1s. 6d.)
- Le Fils du Grand-ferré Robert Jean Boulan*: edited by P. G. Wilson. (Macmillan and Co., 2s.)
- La Flèche d'Or Fortunat Strowski*: edited by F. E. Duchene, and C. Wilks. (Macmillan and Co., 2s.)
- The English Critic*: N. L. Clay. (W. Heinemann, Ltd.)
- Quintilian on Education*: W. M. Smail. (Oxford Clarendon Press, 4s. 6d.)
- Modern English Prose*: Guy Boas. (Macmillan and Co., 2s. 6d.)
- The Birth of the United States*: J. E. Anthony. (Macmillan and Co., 2s.)
- A One-year German Course*: S. H. Steinberg. (Macmillan and Co., 2s. 6d.)
- L'Amulette*: O. Holenkoff. (Macmillan and Co., 1s.)
- Introductory School Mathematics (with Answers)*: L. Crosland. (Macmillan and Co., 2s. 6d.)
- Prose Selections with Exercises*, 4th year: M. Alderton Pink. (Macmillan and Co., 2s. 3d.)
- Fit after Forty*: C. Jeffery. (F. Muller, Ltd., 5s.)
- Letters to African Teachers*: H. J. E. Dumbrell. (Longmans, Green and Co., Ltd., 2s. 3d.)
- Practical Possibilities*: Macpherson Lawrie. (Methuen and Co., Ltd., 3s. 6d.)
- Food Facts and Diet Planning*: G. MacDonald. (Macmillan and Co., Ltd., 3s.)

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MENTAL DISEASE AND CRIME: OUTLINE OF A COMPARATIVE STUDY OF EUROPEAN STATISTICS, by L. S. Penrose; THE R.E.C.I. SERIES OF PERCEPTUAL TESTS: AN EXPERIMENTAL SURVEY, by J. C. Raven; THE INFLUENCE OF POSITIONAL FACTORS ON THE CHOICE OF ANSWERS TO PERCEPTUAL INTELLIGENCE TESTS, by F. M. Miller and J. C. Raven; EXPERIMENTS ON PHYSICALLY AND MENTALLY DEFECTIVE CHILDREN WITH PERCEPTUAL TESTS, by J. C. Raven and A. Waite; STUDIES IN THE APPLICATION OF MENTAL TESTS TO PSYCHOTIC PATIENTS, by Marsh Davidson; A REPLY TO RECENT CRITICISMS OF INTELLIGENCE TESTING, by W. Stephenson; THE WORLD PICTURES OF CHILDREN: A METHOD OF RECORDING AND STUDYING THEM, by Margaret Lowenfeld; REVIEWS.

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